

Keep

1612 S2 SPECTRUM SHAPER

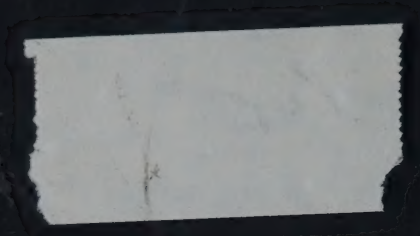


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SPECIFICATIONS FOR 1612/S1 PARALLEL FILTER SET

SK-200 - Frequency Response Characteristics of 1612S Spectrum Shaper

SK-201 - Frequency Response of 1612/S2 With 1620 Extension Filter Set

SK-247 - Frequency Response Characteristics of 1612S2

SK-248 - Simulation of a Partition Wall

SK-422 - Circuit Diagram-1612S2 Spectrum Shaper

1. GENERAL

The 1612/S2 Spectrum Shaper is a 36 Channel $1/3$ Octave Combination Filter which can separate a broad band random noise signal into 36 $1/3$ octave bands in the frequency range from 10 cps to 44 Kcs. After separation the signals are amplified and recombined. Each signal channel is fitted with an attenuator which allows the $1/3$ octaves to be adjusted so that a shaped spectrum of random noise is obtained at the output.

The Spectrum Shaper can also be used as a $1/3$ Octave Analyzer.

2. DESCRIPTION

The 1612/S2 Spectrum Shaper is a modified Bruel & Kjaer 1612 $1/3$ Octave Analyzer. The input connection operates directly or through an input transformer as selected by a front panel switch. In the direct connection an input signal of 1V RMS is required to operate the filters at their optimum level. The source impedance should be 25 ohms or lower. In the transformer coupled mode, the input level should be 10V RMS and source impedance should be no greater than 2000 ohms.

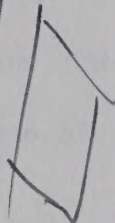
The input signal drives 33 one third octave filters in parallel. The internal filters have center frequencies from 25 to 40,000 cps, however, a rear connector is available to connect the Bruel & Kjaer 1620 Extension Filter Set and this provides three additional channels at center frequencies of 12.5, 16, and 20 cps. The 1612/S2 will operate with or without the 1620 Extension Filter Set.

Each filter output is connected to a two transistor emitter follower amplifier which provides an impedance change from the relatively high filter impedance down to approximately 10,000 ohms. The amplifiers are arranged six channels on one plug in printed circuit card and six cards are mounted on the rear of the 1612 chassis. The original case of the 1612 has been extended back to accommodate the amplifiers, however, the cabinet can be rack mounted with the usual B & K KS 0003. The 36 amplifier outputs are terminated in a rear connector. The scanning switch, originally connected to the filter outputs, is re-wired to the outputs of the 36 amplifiers. A separate amplifier is provided to isolate the scanning analyzer output from the selector switch and this is powered from the 12V power supply which also supplies the 36 amplifiers connected to the filter outputs. Input power is 115V 60Hz.

A separate panel is used to mount the 36 output level controls and this is usually mounted directly above or below the filter unit. Each level control is a log taper potentiometer with reverse characteristics, thus, the output is maximum when the control is fully CCW and the channel is attenuated by turning the control clockwise. The slider of each level control is accessible at a front panel test point. A summing resistor is also connected from the potentiometer slider to a summing bus bar and the summed output is brought out to a rear connector. The maximum output of IV RMS input is approximately 50 mV.

3006

115502 [5.2]



is brought out to a rear connector. The maximum output of 1V RMS input is approximately 50 mV.

3. COMPONENT PARTS

The 1612/S2 consists of:

- 1 - modified Bruel & Kjaer 1612 (1612S1)
- 1 - KS 0003 Rack Mount Adaptor
- 1 - Summing Panel (1612S2-S.P.)
- 1 - Power Cord
- 1 - Accessory Box
- 1 - Instruction Manual

4. OPERATION WITH A BRUEL & KJAER 1402 RANDOM NOISE GENERATOR

The Bruel & Kjaer 1402 Random Noise Generator is a broad band white & pink noise generator which provides an excellent noise source for the 1612/S2.

The 1402 external filter connection provides the correct driving impedance for the direct connection of the filter inputs. The summed output is connected back to the 1402 external filter connection and the shaped signal is amplified by the 1402 output amplifier and indicated on the 1402 output meter.

The 1402 produces random noise with gaussian amplitude distribution. At equal 1/3 octave attenuator settings the 1612/S2 summing panel will have an output in which the energy per 1/3 octave band will increase with frequency at +3 db/octave. The 1402 Random Noise Generator contains a -3 dB/octave

filter which can be switched into circuit to obtain equal energy per $1/3$ octave (pink noise).

The 1402 is equipped with a relay which stops the random noise generator. This relay can be remotely controlled from the 2305 Graphic Level Recorder or any other control source and controlled bursts of random noise can be generated. Further details are given in the 1402 Instruction Manual.

5. USE OF THE EXTENSION FILTER SOCKET FOR REAR CONNECTED INPUT

One JP 0019 Adapter is supplied with the 1612/S2 accessories. If the 1620 Extension Filter Set is not used this adapter may be inserted into the extension filter socket. A standard JP 0018 will now plug into the center of this adapter to provide a rear input connector.

6. ROLL OFF CHARACTERISTICS

The frequency response shown in SK-200 shows the notch characteristics of the 1612S. The 1612S2 is often used as a spectrum shaper to simulate the attenuation characteristics of a building wall. This requires an output which has increasing attenuation with frequency and the notch characteristic does not define the instrument capability. SK-247 shows two roll off settings. Fig. 1 shows the $1/3$ octave outputs from 100 to 1000 cps reducing at 4 db/ $1/3$ octave or 40 db per decade. Fig. 2 shows a similar test at 2000 - 5000 cps with the roll off set at 10 db/ $1/3$ octave or 90 db per decade.

7. SPECIFICATIONS 1612/S2

Frequency Range	22 - 45,000 Hz 11 - 45,000 Hz when used with 1620 Extension Filter Set
Bandpass Filters	1/3 octave - 3 section
Source Resistance of Input Signal	Must be less than 2000 ohms for transformer coupled input. 20 ohms or less for direct input.
Input voltage	1 volt direct 10 volts transformer coupled
Selective output	1/3 octave from selector switch
Summed output	up to 60 mV at summing junction depending on control settings
Signal to noise ratio	60 dB at full output
Scanning method	Manual from front panel or remote stepping from 28V supply
Stepper load	28 volts 180 mA
Summing adjustments	36-33 used with internal filters 3 used with 1620 Extension Filter Set

Accessories

3)JP-0018 Shielded Plugs

1) AQ-0002 Control Cable

1) AQ-0008 Battery Connector

1) KS-0003 Rack Mounting Adapter

Demensions:

Filter Unit

16" wide x 12" high x 14" deep

19" wide x 14" high x 14" deep

when mounted in KS0003 rack mount
adapter.

Summing Panel

19" wide x 7" high x 8" deep

PRICE.....\$3470.00

8. APPLICATIONS8.1 SPECTRUM ANALYSIS

The 1612/S 2 can be used with the 2603, 2604 or 2107 as an external filter. When coupled to the 2305 the combined system will perform a conventional 1/3 octave analysis. It will not operate as a 1 octave analyzer.

8.2 SPECTRUM SHAPING

The 1612/S2 can be used as an external filter with the 1402 to make a shaped spectrum of random noise or with the 2603, 2604 or 2107 to make a shaped frequency response characteristic.

2a: 1402 + 1612/S2 (Shaped Random Noise)

The 1612/S2 is connected between the external filter posts of the 1402 and is used to shape the frequency distribution of random noise. This arrangement is used to simulate noise spectra for the acoustic excitation of aircraft or missile components and structures. It is also used to generate an equivalent noise source especially where the true source is difficult or too costly to operate as a sustained noise generator. In this case the analysis of the actual noise source can be made on the spectrum shaper prior to the simulation.

8.3 2603 + 1612/S2 (Simulation of a structural member)

This arrangement is used to simulate the acoustical properties of structural component such as a partition wall. The specimen partition can be analyzed by using the 1612/S2 as a sequential 1/3 octave filter to shape random noise into 1/3 octave bands and so drive a power amplifier and loud speaker on the source side of the test partition. Measurements are made with two microphones, one on the source side and one on the listening side and subtracting the two readings. A typical set up is shown in SK-248 and the microphone switching is accomplished by a 4408 two channel microphone selector. This method allows the customer to use an inexpensive

power amplifier and loud speaker because the frequency response of the loud speaker need only be flat in a $1/3$ octave band. Deterioration of speaker performance is compensated by the measurement method. A 40 watt power amplifier and a good reflex cabinet can provide sound pressures above 100 dB SPL.

Once the sound transmission characteristics of the specimen are established, the 1612/S2 can be set up by driving it from an oscillator or a random noise generator and the $1/3$ octave levels adjusted using the 2603 as a voltmeter to measure the $1/3$ octave outputs.

The 1612/S2 is then connected to the external filter connections of the 2603 and the partition is simulated electrically. If tape recordings of a sound source (cocktail party, machinery, etc.) are now played into the 2603, the output will be similar to what an observer would hear on the listening side of the partition.

SK-248 shows the signal attenuation through the 1612/S2 when maximum roll-off at 36 dB per octave can be obtained over a range of 60 dB. This is a very important capability for structure simulation and is greatly in excess of any spectrum shape that would be encountered in practice.

8.4 2603 + 1612/S2 (subjective or listening jury tests)

Appliance manufacturers are concerned with the noise output from domestic appliances. They are faced with the difficult task of making a machine which is not acoustically objectionable. This can be accomplished by either building a completely quiet machine or eliminating the objectionable

portion of the noise spectrum. If the operating noise of the appliance is played through a 1612/S2 into an HA-10 headset, the listener can attenuate the noise in 1/3 octave bands to establish the effect of reducing specific noise components so that the appliance becomes acceptable. This is less costly than quieting the whole mechanical system.

1612/S1 PARALLEL FILTER SET

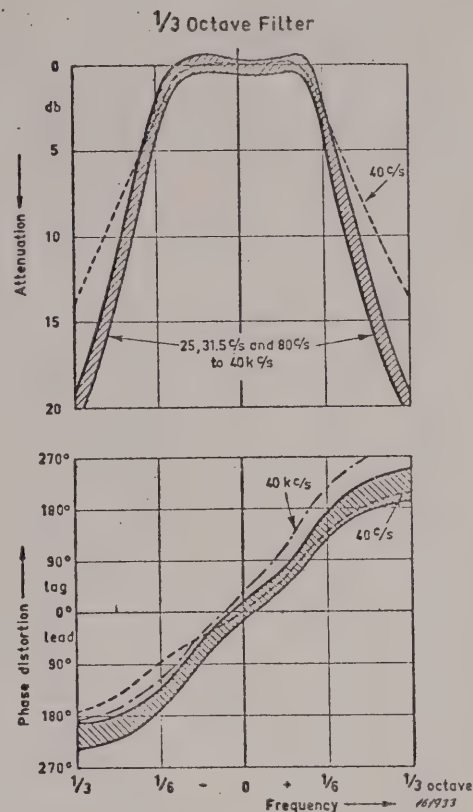
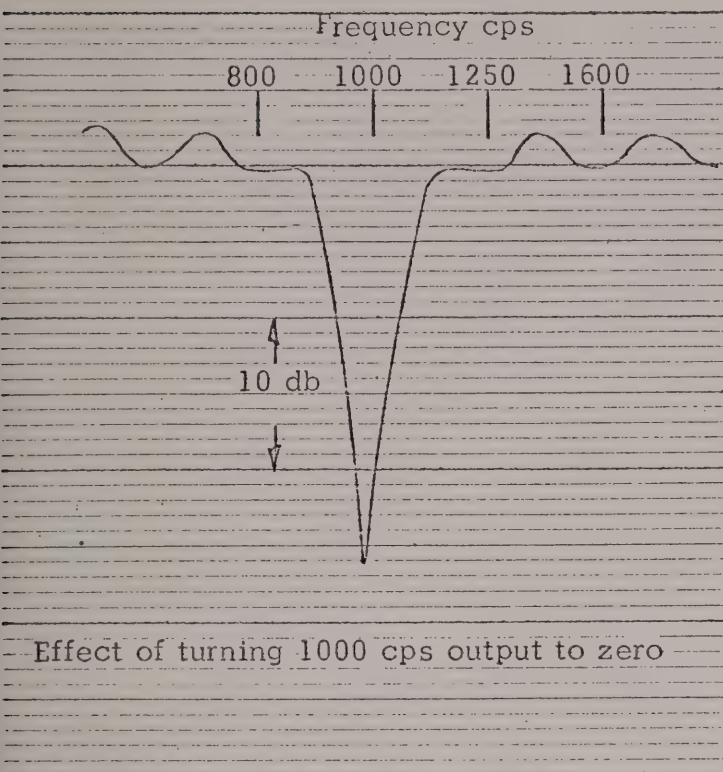
Output connections

Channel	Center frequency	Output connection
1	12.5	A -1
2	16	27
3	20	3
4	25	29
5	31	5
6	40	31
7	50	7
8	63	33
9	80	9
10	100	35
11	125	11
12	160	37
13	200	13
14	250	39
15	315	15
16	400	41
17	500	17
18	630	43
19	800	19
20	1Kcs	45
21	1250	21
22	1600	47
23	2Kcs	23
24	2500	49

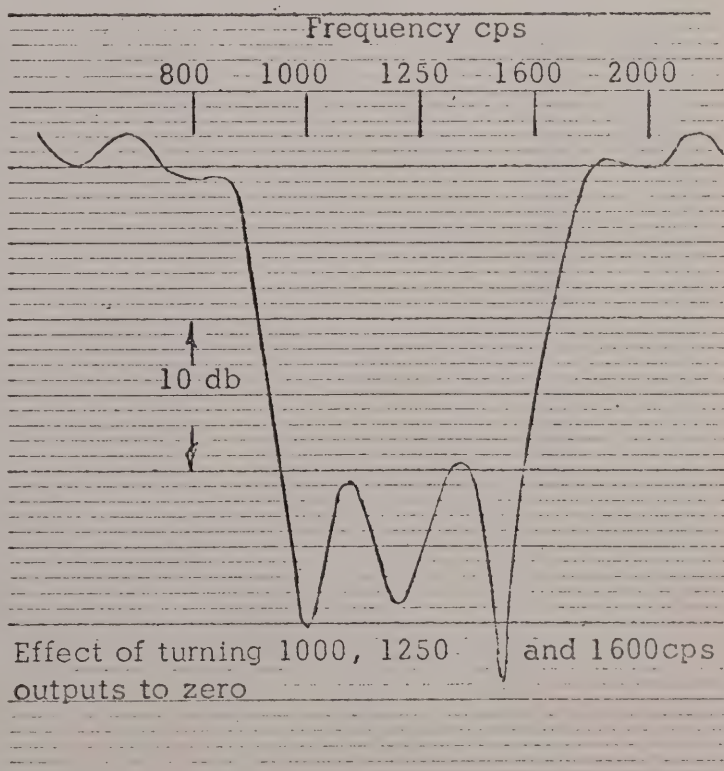
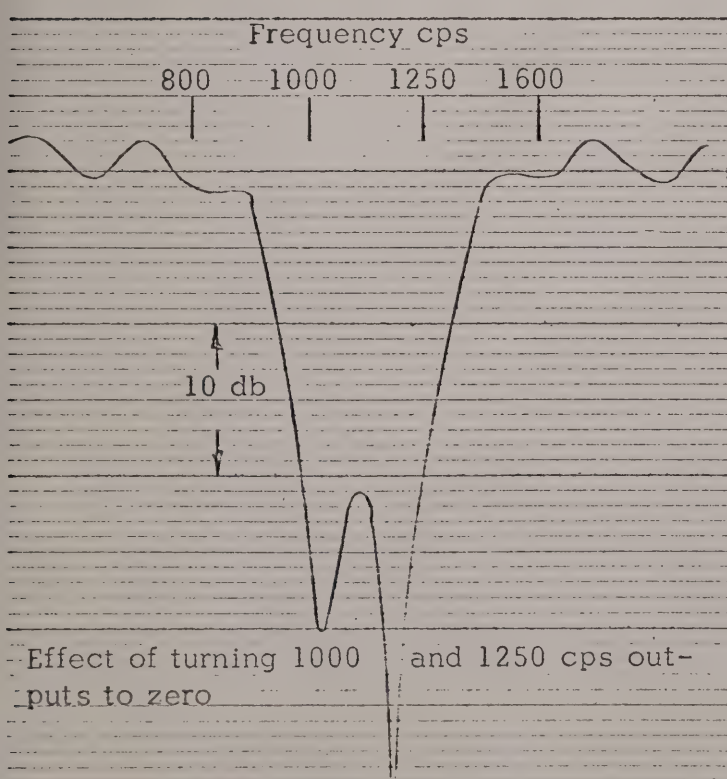
B & K INSTRUMENTS, INC.

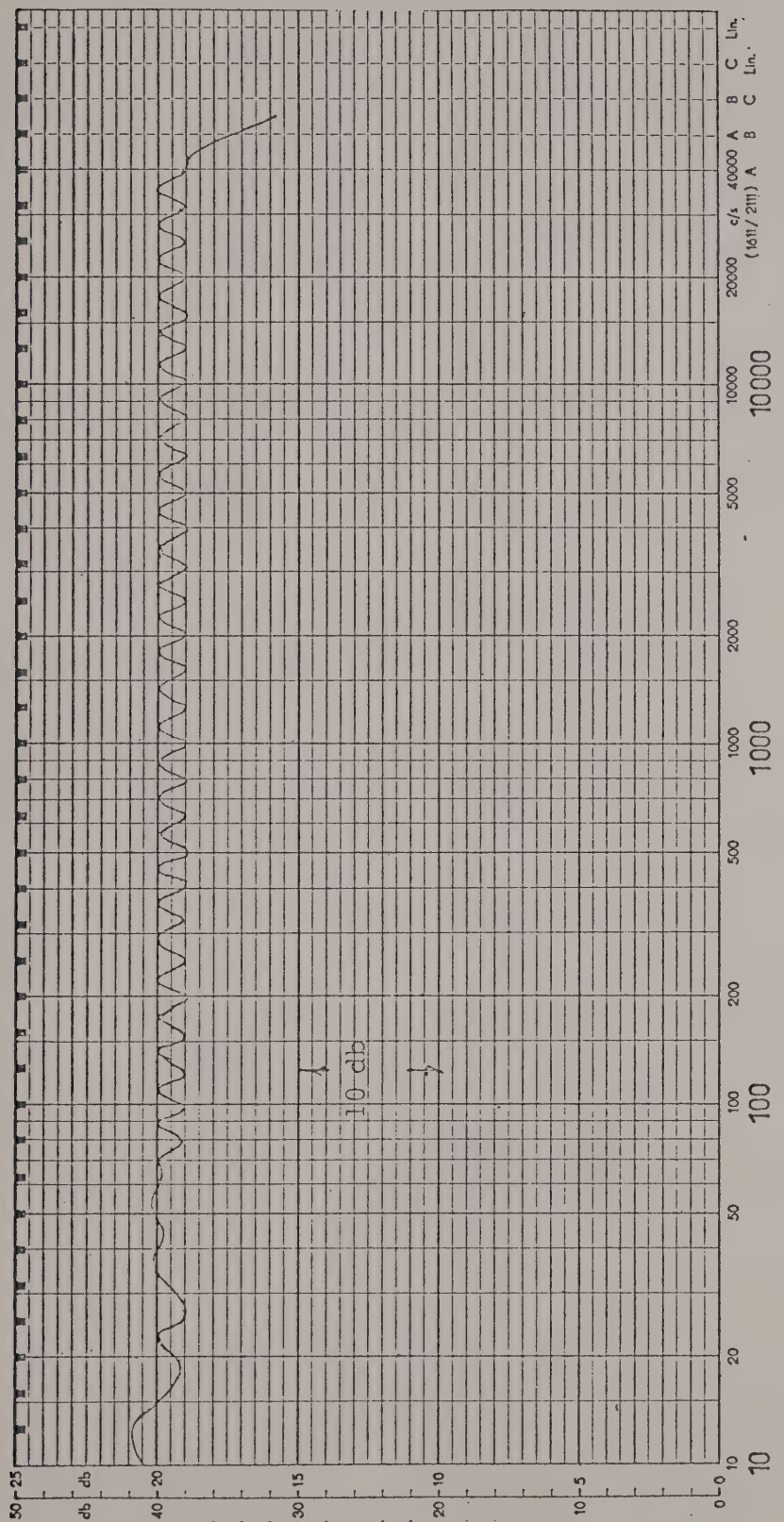
25	3150		25
26	4Kcs	B	1
27	5Kcs		3
28	6300		5
29	8Kcs		7
30	10Kcs		9
31	12.5Kcs		11
32	16Kcs		13
33	20Kcs		15
34	25Kcs		17
35	31.5Kcs		19
36	40Kcs		21
GND		A-50	B-25

FREQUENCY RESPONSE CHARACTERISTICS OF 1612S SPECTRUM SHAPER



PHASE SHIFT CHARACTERISTICS OF 1/3 OCTAVE FILTERS.



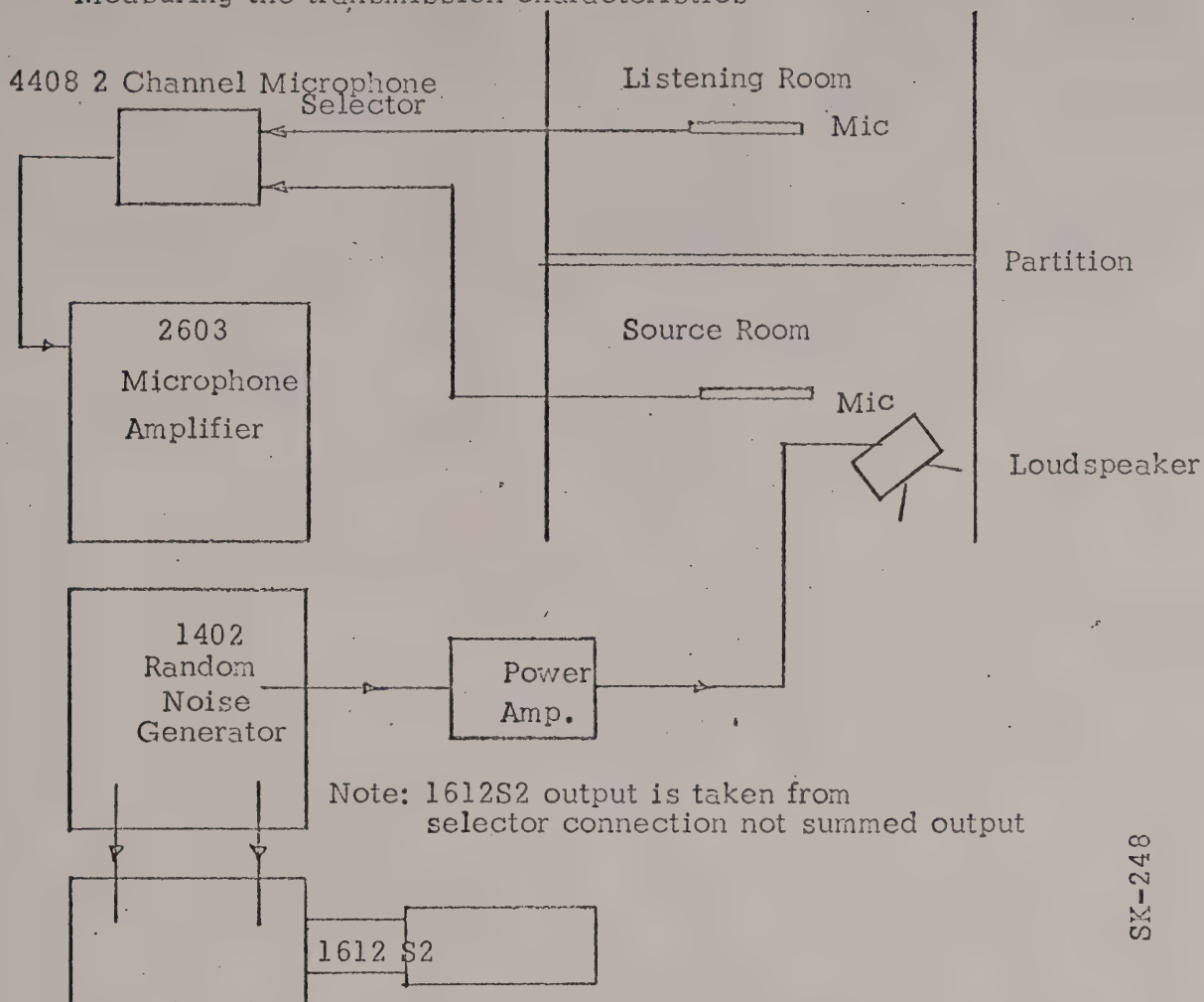


FREQUENCY RESPONSE OF 1612/S/2 WITH 1620 EXTENSION FILTER SET

All output controls at maximum

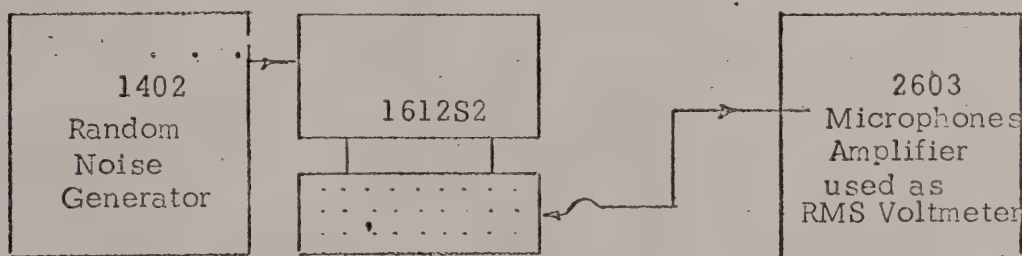
SIMULATION OF A PARTITION WALL

Phase 1 - Measuring the transmission characteristics

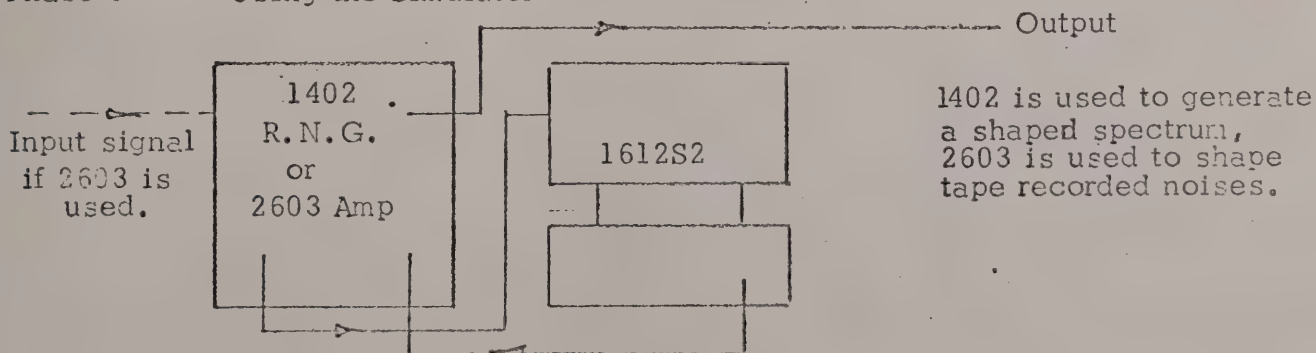


SK-248

Phase 2- Setting up the 1612S2



Phase 3- Using the Simulator



DATE

UNIT, MODEL

ALL FILL CHAINS JOINED
WITH ONE

CONNECTOR, QZ

SEE TABLE ON RIGHT FOR
CONNECTIONS ALSO HAS IN
INSTRUCTIONS MANUAL

CONNECTOR

MOUNTED ON
LEAF BRACKET

SCALE		NEXT ASSY		S.D.	
TITLE: KICK LABELS WPAFT. (MOUNT) NO 12345678901234567890					
B & K INSTRUMENTS, INC. CLEVELAND, OHIO 44143					
DRAWN	DATE	DATE	DATE	SIZE	DRAWING NUMBER
CHECKED	DATE	DATE	DATE	D	1
APPROVED	DATE	DATE	DATE		

INVEST

BEK MODEL 1612. FILTER JET.

PL 1110105		DATE	REMARKS

1. Name of the person or organization 2. Address 3. City 4. State 5. Zip	6. Date 7. Time 8. Location 9. Other
10. Name of the person or organization 11. Address 12. City 13. State 14. Zip	15. Date 16. Time 17. Location 18. Other

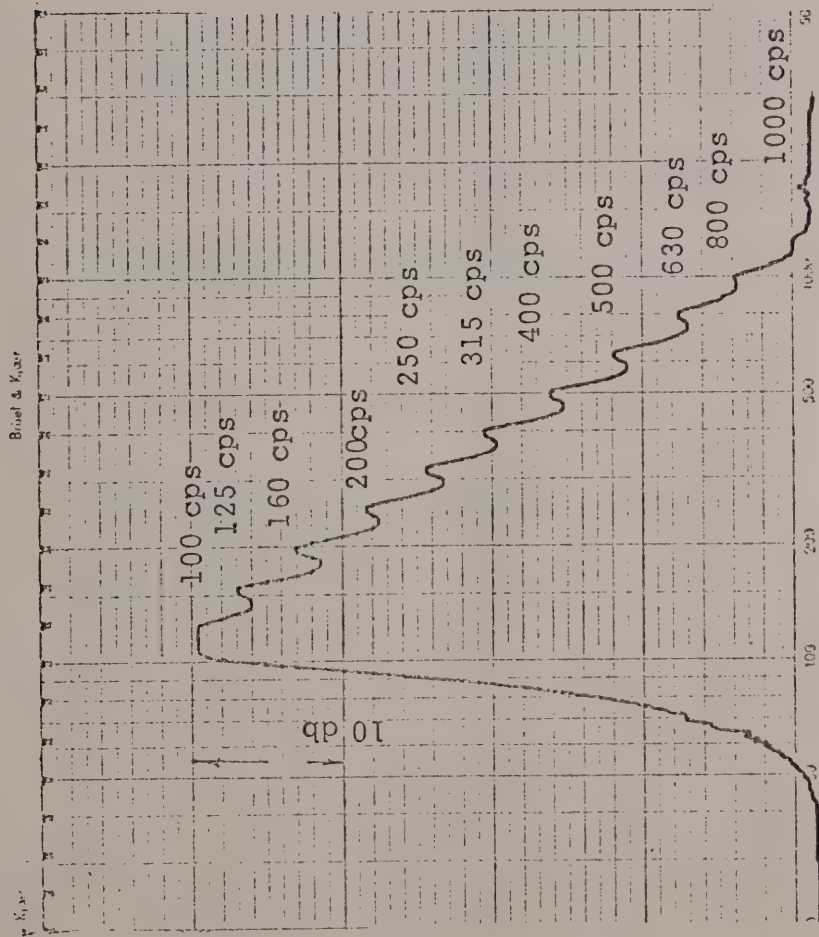


Fig. 1 100 cps to 1 Kcs rolling off
at -4 db per 1/3 octave
(-12 db per octave)

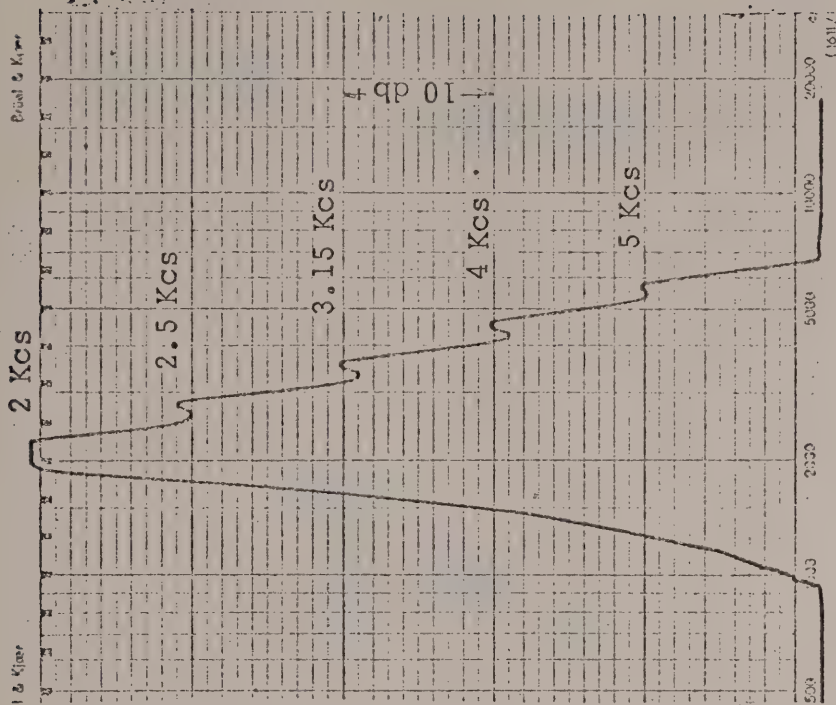


Fig. 2 2 Kcs to 5 Kcs rolling off
at 10 db per 1/3 octave
(30 db/octave)

Note: All other 1/3 Octaves turned off.

Consisting of:

Filter Curves	1612.1
Weighting Network	1612.2
Level Adjustment	1612.3
Complete Adjustment	1612.4
Octave-Frequency Table	1612.5
Automatic Switching Device	1612.6
Position of Components	1612.7
Parts List	1612.8
Circuit Diagram	1612.9

Removal of the Metal Case.

After removing the four threaded retainers at the back of the instrument, it is possible to slide the chassis and the front panel out of the case.

Trouble Shooting.

If the reason for a fault is not an obvious one such as faulty transistor, broken down resistor, etc., then first test the voltages of the transistors and compare them with the voltages shown in the printed circuit (Position of components 1612.7) in order to localize the defect. Should this method of finding the fault prove unsuccessful, then check the instrument by adopting the method described in the adjustment procedure. To correct a fault in a filter the filter drawer in question must be taken out. This can be done after the leads to the drawer have been unsoldered and the two screws which hold the drawer in place removed. The drawer will be rather tight at beginning, as the other end is held firmly by a pair of springs. When the trouble has been found and remedied, the voltages and adjustments which are influenced by the remedy must be rechecked.

The tolerances stated in the instructions can only be used as a guide for adjustment and control, but any deviations must not be corrected without being sure that the tolerances of the instruments used for making the adjustment are so small as to have no influence on the measurements.

The instructions in this Manual are given purely as a guide to the service of equipment. Some faults, as f.inst. small deviations in tolerances require for their correction special control equipment and extensive experience, and in these cases it is necessary to send the instrument to the factory.

Spare Parts.

Please state type and serial number of apparatus when spare parts are ordered.

Instruments and accessories necessary for service and repair:

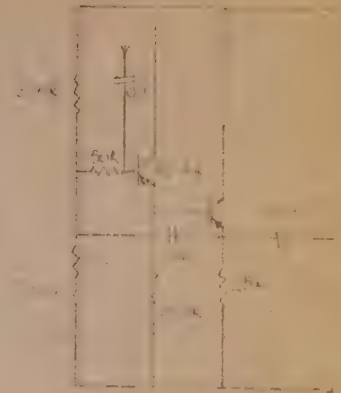
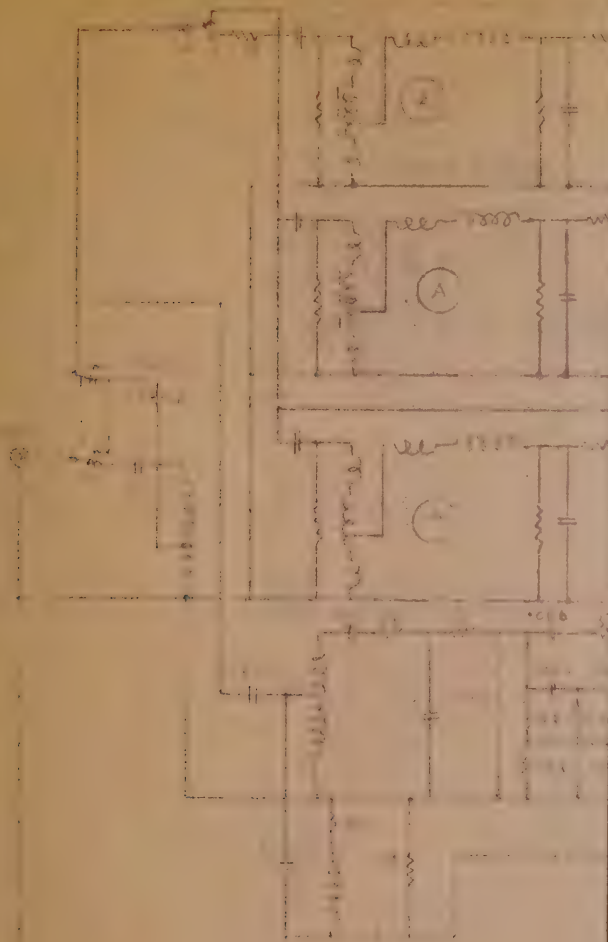
Multimeter (50 μ A)
Frequency Analyzer type 2107
Beat Frequency Oscillator type 1022
(Beat Frequency Oscillator type 1013)
(Frequency Counter)
Pressure Gauge (30 - 50 gr)

REVISIONS

DESCRIPTION

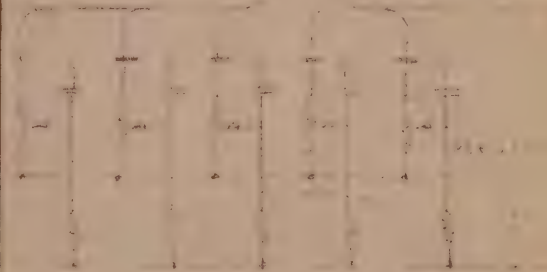
DATE

APPROVAL



ALTERNATE AMP. CIRCUIT

ILLUSTRATED



NOT TO SCALE ABOVE

SK422-2 INCORPORATES
OPERATION OF JAWAGE
OUTPUT AND...
INTERNAL CIRCUITRY

EXT
SS'Y

S.O.

LIASAM -
ECIRUM

B & K INSTRUMENTS, INC.
CLEVELAND, OHIO 44142

DATE 19 DEC 66

SIZE

DRAWING NUMBER

ISSUE

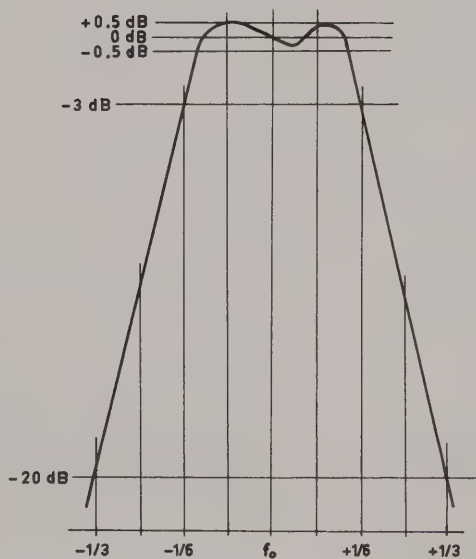
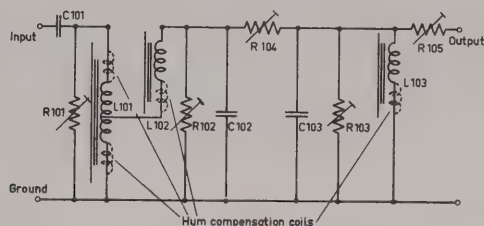
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B

SK422

2

1/3 Octave Filter

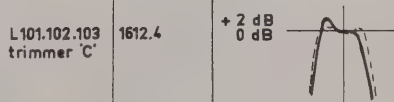
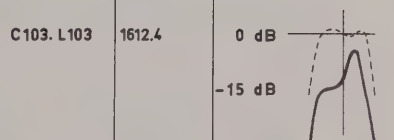
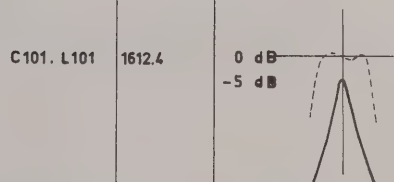
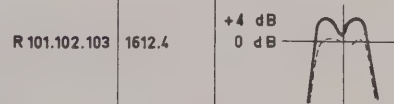
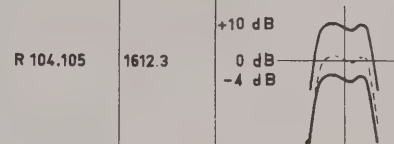


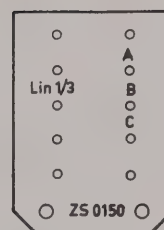
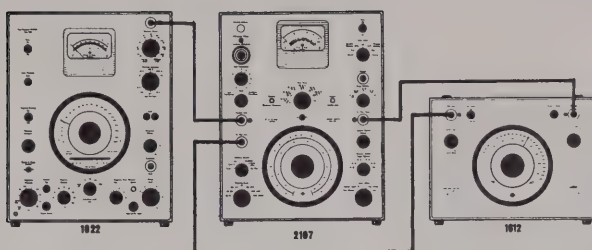
L 101	↓	↑	↑	↓	↓	↑	Change in filtercurve if the iron core or adjustmentape are moved out of the coil
L 102	↓	↑	↑	↓	↓	↑	
L 103	↑	↓	↓	↑	↑	↓	
R 101	↓	↓	↓	↓	↓	↓	Change in filtercurve if the potentiometer is adjusted to a smaller resistance
R 102	↓	↓	↓	↓	↓	↓	
R 103	↓	↓	↓	↓	↓	↓	
R 104	↓	↓	↓	↓	↓	↓	
R 105	↓	↓	↓	↓	↓	↓	

Typical filtercurves for faulty filters



Faulty component	Adjustment procedure	Filtercurve for faulty filter
R 104, 105	1612.3	+10 dB 0 dB -4 dB
R 101, 102, 103	1612.4	+4 dB 0 dB
C 101, L 101	1612.4	0 dB -5 dB
C 103, L 103	1612.4	0 dB -15 dB
L 101, 102, 103 trimmer 'C'	1612.4	+2 dB 0 dB





2.1. Linear

- a. INPUT SWITCH: "Direct"
WEIGHTING NETWORK: "On"
FILTER SWITCH: "Lin."
FUNC.SELECTOR: "1/3 Octave"

Frequency: 1000 c/s. Adjust the input voltage for an 18 dB deflection on type 2107 (RANGE MULT.: "x1" and WEIGHTING NETWORK: "Lin. 2-40000 c/s")

Change WEIGHTING NETWORK on type 2107 to "Ext. Filter".

Change frequency to 50 c/s.

Deflection on type 2107: 17.8 - 18.2 dB.

If necessary adjust R 99 "Lin. 1/3"

Possible reasons for fault: defective transistor V1, V2
defective zener diode Q1.

d.c. voltage for transistor amplifier: Q1: approx. 12 V

V2 emitter: approx. 5 V

base: approx. 4.8 V.

Vary the frequency from 20-20000 c/s.

Deflection on type 2107: 18 dB

Tolerance: ± 0.3 dB (+ tolerance of type 1022: ± 0.3 dB and type 2107: ± 0.2 dB)

- b. FUNC.SELECTOR to
"1/1 Octave"

Vary the frequency from 20 - 20000 c/s.

Deflection on type 2107: 18 dB (RANGE MULT.: "x 0.3").

Tolerance: ± 0.6 dB (+ tolerance of type 1022: ± 0.3 dB and type 2107: ± 0.2 dB)

If necessary change value of C 91 or R 88.

2.2. A-B-C Curves

- a. INPUT SWITCH: "Direct"
WEIGHTING NETWORK: "On"
FILTER SWITCH: "Lin."
FUNC.SELECTOR: "1/3 Octave"

Frequency: 1000 c/s. Adjust the input voltage for an 18 dB deflection on type 2107 (RANGE MULT.: "x1" and WEIGHTING NETWORK: "Lin. 2-40000 c/s")

Change WEIGHTING NETWORK on type 2107 to "Ext. Filter".

- b. FILTER SWITCH to curve A

Deflection on type 2107: 17.7 - 18.3 dB.

If necessary adjust R 98 "A".

- c. FILTER SWITCH to curve B

Deflection on type 2107: 17.7 - 18.3 dB.

If necessary adjust R 97 "B".

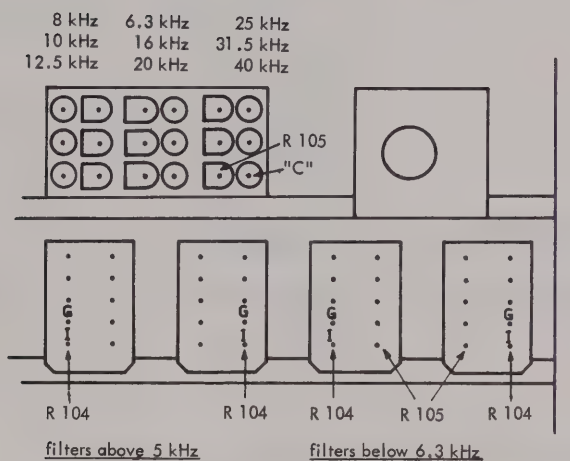
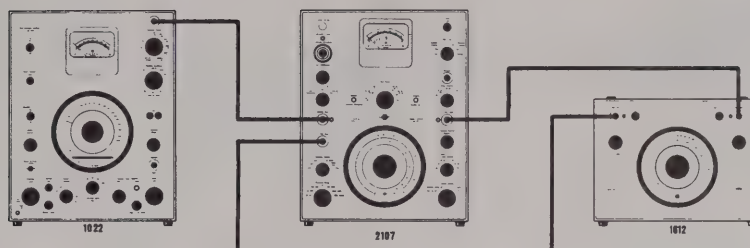
- d. FILTER SWITCH to curve C

Deflection on type 2107: 17.7 - 18.3 dB.

If necessary adjust R 94 "C".

Whenever R 94, 97, 98 is adjusted item e should be checked as the settings of these potentiometers influence each other.

Frequency c/s	Curve "A"		Curve "B"		Curve "C"	
	Defl. on type 2107 dB	RANGE MULT.	Defl. on type 2107 dB	RANGE MULT.	Defl. on type 2107 dB	RANGE MULT.
20	4.6 - 12.6	X 0.01	10.6 - 18.6	X 0.1	8.7 - 16.7	X 1
63	10.4 - 13.9	X 0.1	7.1 - 10.6	X 1	15.7 - 19.2	X 1
500	14.4 - 15.2	X 1	17.3 - 18.1	X 1	17.6 - 18.4	X 1
1000	17.7 - 18.3	X 1	17.7 - 18.3	X 1	17.7 - 18.3	X 1
2000	19.0 - 19.4	X 1	17.6 - 18.0	X 1	17.6 - 18.0	X 1
8000	15.7 - 17.4	X 1	13.8 - 15.5	X 1	13.8 - 15.5	X 1
20000	6.8 - 10.3	X 1	15.0 - 18.5	X 0.3	14.9 - 18.4	X 0.3



3.1. 1/3 Octave Filter

- a. INPUT SWITCH: "Direct"
FUNC.SELECTOR: "1/3 Octave"
WEIGHTING NETWORK: "On"

Set the frequency to the center frequency of the filter and adjust the input voltage for an 18 dB deflection on type 2107 (RANGE MULT.: "X1" and WEIGHTING NETWORK: "Lin. 2-40000 c/s").

Change WEIGHTING NETWORK on type 2107 to "Ext. Filter".

- b. FILTER SWITCH in required position
25-5000 c/s

Vary the frequency around the center frequency of the filter and check the filter curve.

Deflection on type 2107: 18.0 - 18.5 dB for the tops
17.5 - 18.0 dB for the valleys

If necessary adjust R104 or R105.

Change frequency to + and - 1/6 octave
Deflection on type 2107: approx. 15 dB.
After adjustment of R104-105, check 3.2

- c. FILTER SWITCH in required position
6300 - 16000 c/s

As under item b but adjust the valleys by means of R104 or R105 and the tops by means of trimmer "C".

- d. FILTER SWITCH in required position
20000 - 40000 c/s

Check of these filters requires use of a high frequency oscillator f.inst. type 1013.

Check and tolerances as under item c.

3.2. 1/1 Octave Filter

- a. INPUT SWITCH: "Direct"
FUNC. SELECTOR: "1/1 Octave"
WEIGHTING NETWORK: "On"

Set frequency to the center frequency of the filter and adjust the input voltage for an 18 dB deflection on type 2107 (RANGE MULT.: "X1" and WEIGHTING NETWORK: "Lin. 2-40000 c/s")

Change WEIGHTING NETWORK on type 2107 to "Ext. Filter" and RANGE MULT. to "X0.3".

Vary the frequency around the center frequency of the filter.

Deflection on type 2107: 18 - 20 dB for the tops
16 - 18 dB for the valleys

Change frequency to + and - 1/2 octave.

Deflection on type 2107: approx. 15 dB

If necessary to adjust the filter. Set the frequency at the point where the deflection exceeds the tolerance and note the deviation from 18 dB deflection on type 2107.

Change FUNC. SELECTOR to "1/3 Octave" and turn the FILTER SWITCH to the defect 1/3 octave filter, indicated by the greatest deflection on type 2107 (RANGE MULT.: "X1")

Change frequency to the center frequency of the defect filter and adjust the deflection on type 2107 by means of R104 to the deviation just noted from 18 dB deflection, but in opposite direction.

Then adjust R105 for a deflection on type 2107: 17.5-18.0 dB and repeat item b.

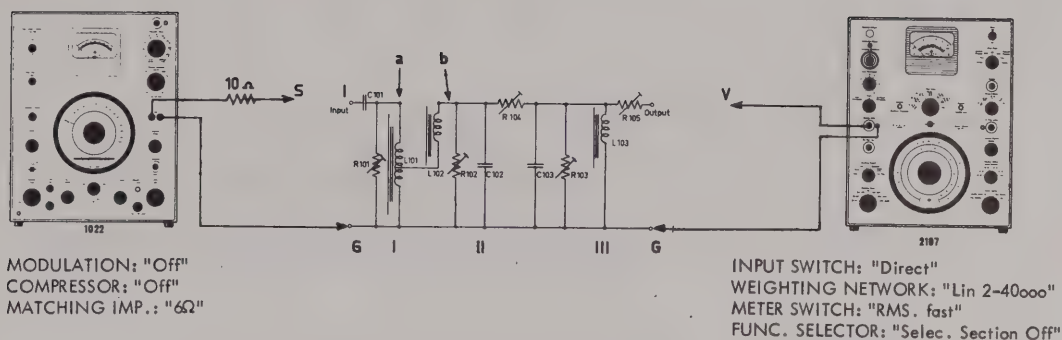
- c. FILTER SWITCH in required position
125-8000 c/s

Adjustment as under item b,
but deflection on type 2107: 18 - 19 dB for the tops
17 - 18 dB for the valleys.

- d. FILTER SWITCH in required position
16000 - 31000 c/s

Adjustment of these filters requires use of a high frequency oscillator f.inst. type 1013.

Adjustment and tolerances as under item c.



Before adjustment turn potentiometer R101-2-3 to mid. position R104 to max. resistance and R105 to min. resistance.

4.1. Adjustment of Resonant Circuit I and II

a. Reference adj.

Connect: S and V to point I
b to point G

Set the frequency to the center frequency of the filter and adjust the input voltage for an 18 dB deflection on type 2107 (RANGE MULT.: "x1" and METER RANGE: "1 V").

b. Adj. of resonant frequency L 101.

Change V to point a.

Change frequency to approx. 1% above the center frequency of the filter and adjust L 101 to max. deflection on type 2107.

c. Adj. of Q, R 101.

Adjust R101, if any (some of the low frequency filters have no R101), for a 19 dB deflection on type 2107 (RANGE MULT.: "x1" and METER RANGE: "10 V").

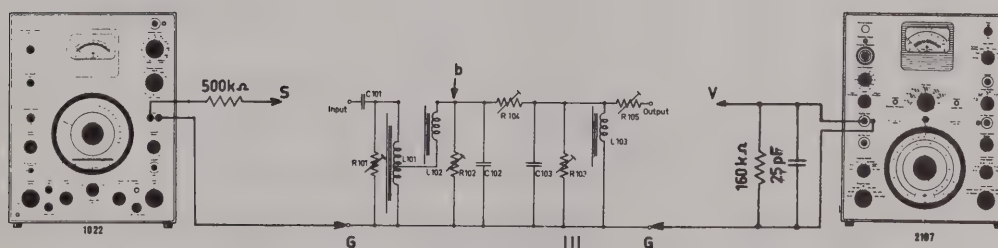
d. Adj. of resonant frequency L 102.

Connect: S to point a.
V to point b.
Filter output to point G.

Adjust L102 to max. deflection on type 2107 at the same frequency as under item b.

e. Adj. of Q, R102

Adjust R102, if any (some of the low frequency filters have no R102), for a 10 dB deflection on type 2107 (RANGE MULT.: "x0.3" and METER RANGE: "10 V").



4.2. Adjustment of Resonant Circuit III

a. Reference Adj.

Connect: S to V.

Set the frequency to the center frequency of the filter and adjust the input voltage for an 18 dB deflection on type 2107 (RANGE MULT.: "x1" and METER RANGE: "1 V").

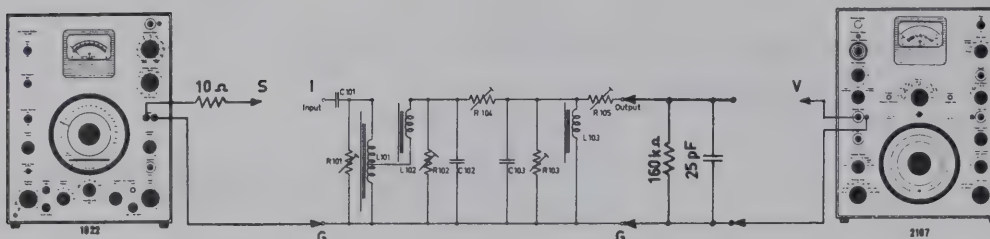
b. Adj. of resonant frequency. L 103.

Connect: S and V to filter output
b to point G

Set the frequency to approx. 1% below the center frequency of the filter and adjust L103 to max. deflection on type 2107.

c. Adj. of Q R 103.

Adjust R103, if any (some of the low frequency filters have no R103), for a 10 dB deflection on type 2107 (RANGE MULT.: "x 0.3" and METER RANGE: "1 V").



Adjustment of attenuation at $\pm 1/6$ and $\pm 1/3$ octave requires use of a frequency counter connected to type 1022 as the accuracy of the frequency should be within 0.1 - 0.2%.

4.3. Adjustment of Filter Curve

a. Reference adj.

Connect: V and S to point I

Set frequency to the center frequency of the filter and adjust the input voltage for an 18 dB deflection on type 2107 (RANGE MULT.: "x 1" and METER RANGE: "1 V").

b. Filter tops and valleys

Change V to filter output.

Vary the frequency around the center frequency of the filter.

Average deflection on type 2107: 18 dB.

If necessary adjust R104.

check that the 2 tops have the same height.

If necessary adjust L103.

Check the deflection on type 2107: 18.0-18.5 dB for the tops
17.5-18.0 dB for the valleys

If necessary adjust R103 (or R101-2)

c. Attenuation at $\pm 1/3$ octave.

Check that the attenuation at $\pm 1/3$ octave is equal.

Attenuation: Filters below 1000 c/s approx. 18 dB
Filters above " " " 20 dB

If necessary adjust L101-2-3 in the same direction.

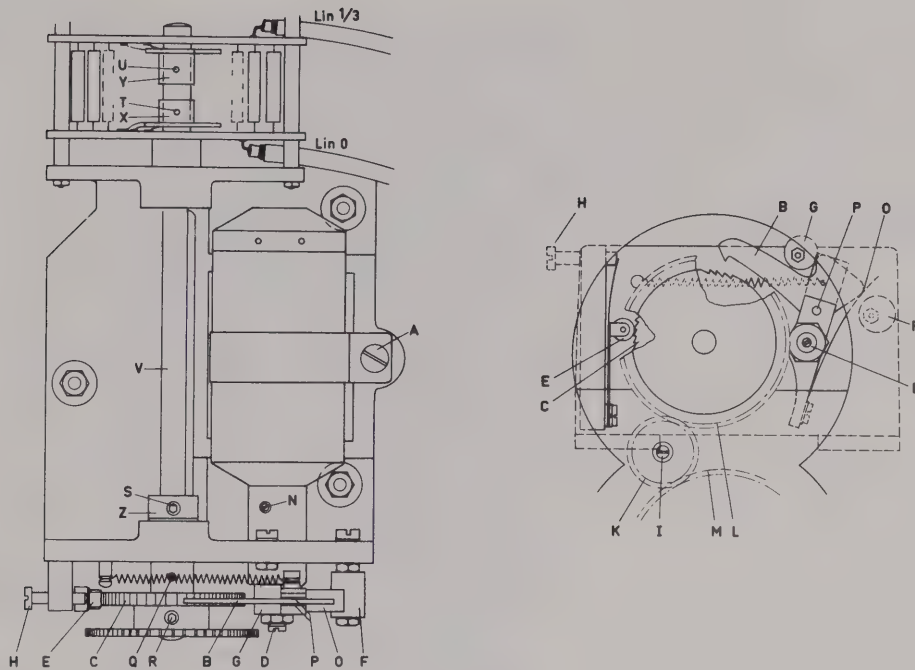
d. Attenuation at $\pm 1/6$ octave

Check that the attenuation at $\pm 1/6$ octave is equal.

Attenuation: approx. 3 dB
If necessary adjust L101-2-3 in the same direction.

After adjustment mount the filter drawer in type 1612 and check the filter according to 1612.3.

- octave			center frequency c/s	+ octave		
1/2	1/3	1/6		1/6	1/3	1/2
11.22	10.00	11.22	12.5	14.13	15.85	22.40
	12.59	14.13	16	17.78	19.95	
	15.85	17.78	20	22.40	25.10	
22.40	19.95	22.40	25	28.20	31.60	44.70
	25.10	28.20	31.5	35.50	39.80	
	31.60	35.50	40	44.70	50.10	
44.70	39.80	44.70	50	56.20	63.10	89.10
	50.10	56.20	63	70.80	79.40	
	63.10	70.80	80	89.10	100.0	
89.10	79.40	89.10	100	112.2	125.9	177.8
	100.0	112.2	125	141.3	158.5	
	125.9	141.3	160	177.8	199.5	
177.0	158.5	177.8	200	224.0	251.0	355.0
	199.5	224.0	250	282.0	316.0	
	251.0	282.0	315	355.0	398.0	
355.0	316.0	355.0	400	447.0	501.0	708.0
	398.0	447.0	500	562.0	631.0	
	501.0	562.0	630	708.0	794.0	
708.0	631.0	708.0	800	891.0	1000	1413
	794.0	891.0	1000	1122	1259	
	1000	1122	1250	1413	1585	
1413	1259	1413	1600	1778	1995	2820
	1585	1778	2000	2240	2510	
	1995	2240	2500	2820	3160	
2820	2510	2820	3150	3550	3980	5620
	3160	3550	4000	4470	5010	
	3980	4470	5000	5620	6310	
5620	5010	5620	6300	7080	7940	11220
	6310	7080	8000	8910	10000	
	7940	8910	10000	11220	12590	
11220	10000	11220	12500	14130	15850	22400
	12590	14130	16000	17780	19950	
	15850	17780	20000	22400	25100	
22400	19950	22400	25000	28200	31600	44700
	25100	28200	31500	35500	39800	
	31600	35500	40000	44700	50100	



6.1. Mechanical Adjustment

a. Max. operating power

Operate the FILTER SWITCH automatically, by means of pulses from a Level Recorder Type 2305 or an external DC supply (24 V, 180 mA) in series with a switch, connected to REMOTE CONTROL jack. (+ should be connected to pin 2 and - to pin 1).

Loosen screw A and rotate the motor until max. operating power is obtained.

Before retightening screw A check that the pawl B is located in the middle of the pawl wheel C.

b. Pawl mechanism

Turn the motor axle D clockwise to its limit. Check that the spring loaded locking roll E is in a position between 2 teeth on the pawl wheel C. If not loosen the nut and turn the eccentric nylon bush F to the correct position. After adjustment carefully retighten the nut.

Turn the motor axle D slowly clockwise and check the movement of the pawl B. The pawl should first move down to the pawl wheel C on a point between 2 teeth and then turn the pawl wheel one position. If not, loosen the nut and turn the eccentric nylon bush G to the correct position. After adjustment carefully retighten the nut.

Replace the frequency pointer and the bakelite knob.

Adjust the spring load on locking roll E by means of screw H. The movement of the FILTER SWITCH should be smooth but the screw should be tightened so that the pressure can overcome the friction in the switch and move the pawl wheel back again if it is left a little out of locking position.

Operate the FILTER SWITCH automatically as under item a and check that the switching is stable, if not readjust screw H.

c. Play in the frequency pointer.

Loosen screw I and tighten it again in a position where the play between the nylon wheel K and both the metal wheels L and M is small, but without any point where the wheels are moved with force.

d. Lubricating

Apply a little thin non-acidic machine oil (e.g. sewing machine oil) only to the following parts: Motor, point N

Switching axle, point Q

Pawl mechanism, point O, P

6.2. 50 Position Switch

a. Cleaning

Remove the protecting tape from the left side of the switch.

Loosen screws R-S-T-U and pull out axle V for enough so that the rotary contacts X-Y are free.

Carefully clean the fixed and rotary contacts with a soft cloth and trichloroethylene.

b. Contact Pressure

After cleaning replace the rotary contacts X-Y and axle V, tighten the pawl wheel C and stop-bush Z in a position which allows only a slight play in the axial direction.

Adjust the rotary contacts X-Y along the axle for a contact pressure of 30-40 gr. and tighten screws T-U.

c. Check of Switch

Connect an ohmmeter across the core in the coax cable "Lin. 1/3" and the green lead connected to soldering tag "Lin. 1/3" on filter drawer ZS 0150 and turn the FILTER SWITCH to a position where the resistance is 0.

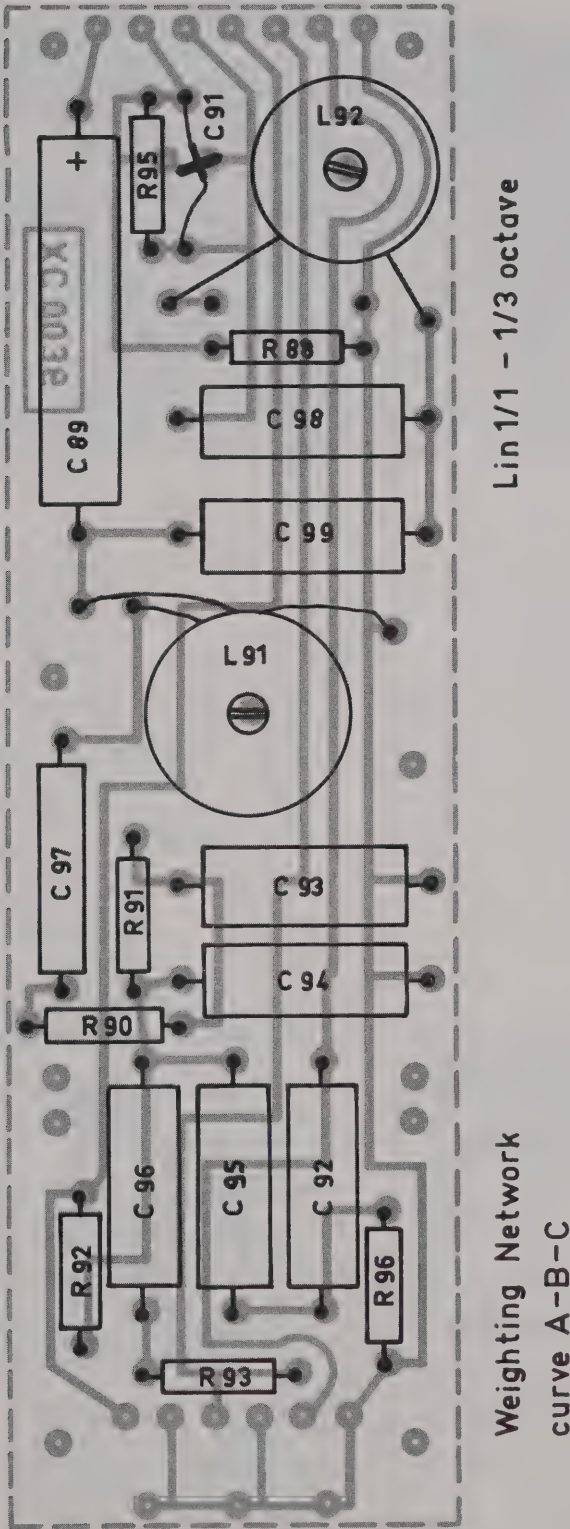
Replace the frequency scale and fix the pointer in position "Lin."

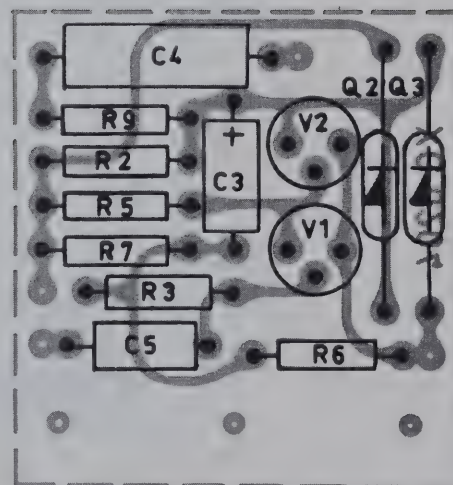
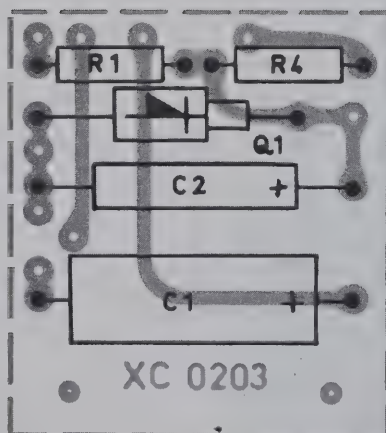
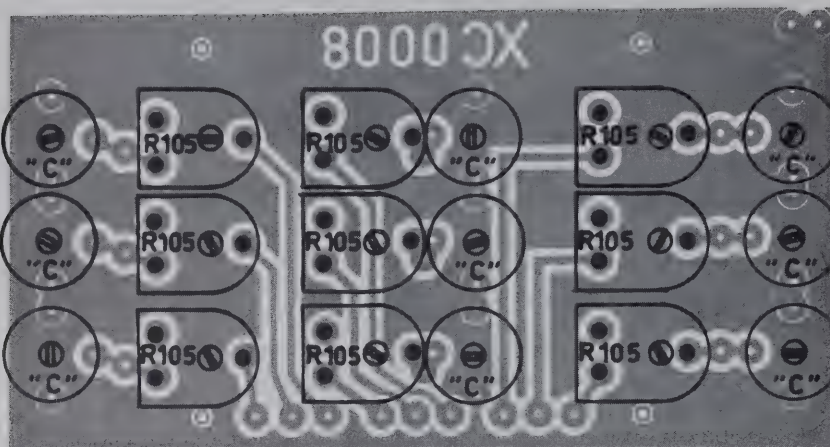
Check that the rotary contact Y is placed on the axle V in relation to the pawl wheel so that it gives contact symmetrically around the locking position. If not loosen screw U and correct the position of the rotary contact.

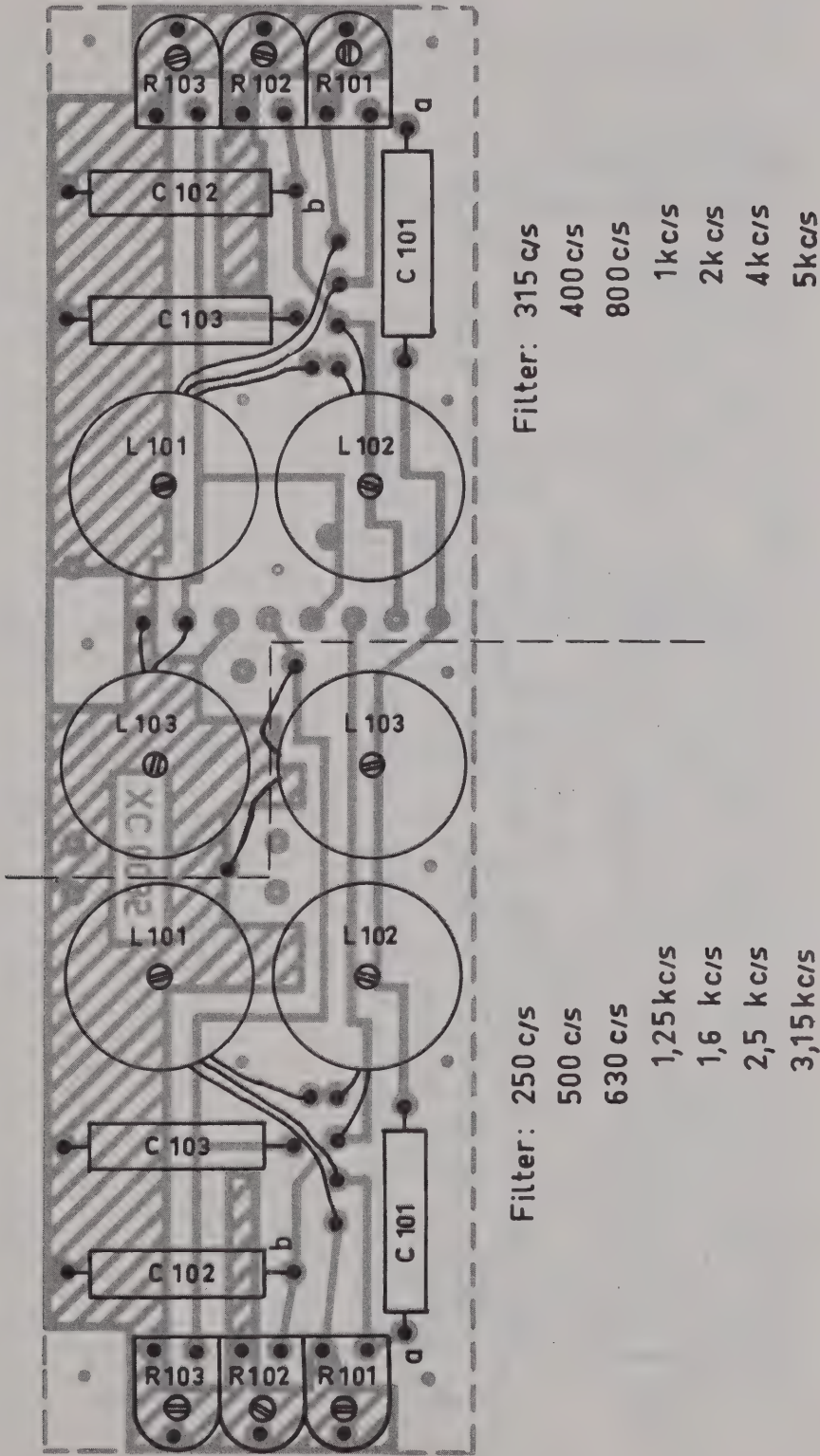
After adjustment recheck contact pressure.

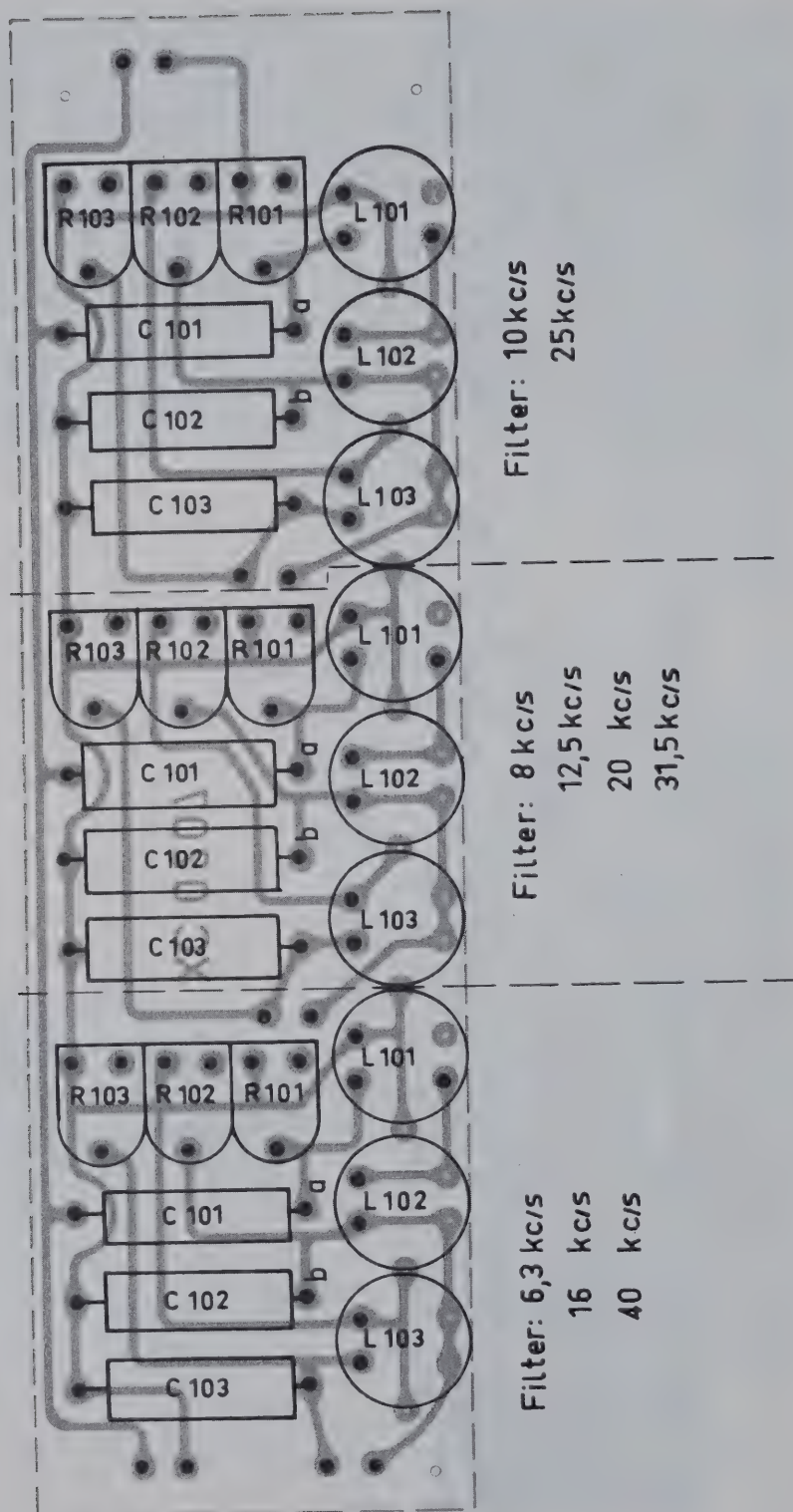
Connect the ohmmeter across the core in the coax cable "Lin. 0" and the red lead connected to soldering tag "Lin. 0" on filter drawer ZS 0150. Set the FILTER SWITCH to "Lin."

Check the rotary contact X in the same way as rotary contact Y.









COMPONENT TYPE	STOCK REFERENCE	CIRCUIT DIAGRAM	COMPONENT	STOCK REFERENCE	CIRCUIT DIAGRAM
CAPACITORS:					
Electrolytic	40 $\mu\text{F}/170\text{ V}$	CE 2038	C 1	Polystyrene 3.16 nF $\pm 2\%/200\text{ V}$	CT 3127 C 94
"	25 $\mu\text{F}/50\text{ V}$	CE 8948	C 2	" 4 nF $\pm 2\%/200\text{ V}$	CT 3325 C 92,93,95
"	10 $\mu\text{F}/12\text{ V}$	CE 0001	C 3	" 6.3 nF $\pm 2\%/200\text{ V}$	CT 3346 C 96
Polyester	0.1 $\mu\text{F}/250\text{ V}$	CS 0013	C 5	" 63 nF $\pm 2\%/100\text{ V}$	CT 3130 C 97,98
"	0.47 $\mu\text{F}/250\text{ V}$	CS 0021	C 4	Auto-transformer	LB 0017 L 91
SWITCHES:					
Input switch	NN 0564	O 1	Coil	50 H	LB 0431 L 92
Weighting Network	NN 0567	O 5	Trimmer pot.m.	150 k Ω lin.	PG 4151 R 94
Function Selector	OR 1611	O 2	"	1M Ω lin.	PG 5102 R 97-99
Automatic switching	OZ 1016	O 4	Carbon film	1/3 W $\pm 5\%$	RK 400 Ω R 89
			"	" $\pm 2\%$	RK 3.15 k Ω R 90,91
			"	"	RK 14 k Ω R 92
			"	"	RK 32 k Ω R 93
			"	"	RK 160 k Ω R 95,96
RESISTORS:					
Carbon film	1/3 W $\pm 10\%$	RK 250 Ω	R 107	1/3 OCTAVE FILTERS:	
"	"	RK 1 k Ω	R 9	FILTER 12.5 c/s:	
"	"	RK 12.5 k Ω	R 1	Polyester	1 $\mu\text{F} \pm 10\%/250\text{V}$ CS 0025 C 101-103
"	"	RK 25 k Ω	R 2	Trimmer pot.m.	300 k Ω lin. PG 4300 R 103,105
"	"	RK 50 k Ω	R 3	"	250 k Ω lin. PG 4250 R 104
"	"	RK 100 k Ω	R 4	Coil	80 H LB 0504 L 102,103
"	"	RK 200 k Ω	R 5	"	80 H LB 0505 L 101
"	"	RK 370 k Ω	R 7	FILTER 16 c/s:	
"	"	RK 430 k Ω	R 6	Polyester	1 $\mu\text{F} \pm 10\%/250\text{V}$ CS 0025 C 101-103
"	"	RK 2 M Ω	R 8	"	0.68 $\mu\text{F} \pm 10\%/250\text{V}$ CS 0023 C 101-103
"	1/2 W $\pm 10\%$	RK 425 k Ω	R 117-120	Trimmer pot.m.	300 k Ω PG 4300 R 103,105
PRINTED CIRCUITS:					
Emitter follower	XC 0204			"	250 k Ω PG 4250 R 104
Weighting network	XC 0036			Coil	63 H LB 0502 L 102,103
Filter	XC 0203			"	63 H LB 0503 L 101
"	XC 0008			FILTER 20 c/s:	
"	XC 0035			Polyester	1 $\mu\text{F} \pm 10\%/250\text{V}$ CS 0025 C 101-103
"	XC 0058			"	0.22 $\mu\text{F} \pm 10\%/250\text{V}$ CS 0017 C 101-103
XC 0204 with components	1612 bl.801			Trimmer pot.m.	300 k Ω lin. PQ 4300 R 103,105
XC 0203	1612 bl.800			"	250 k Ω lin. PQ 4250 R 104
MISCELLANEOUS:					
Cable for battery (1612)	AQ 0008			Coil	50 H LB 0501 L 101
Cable for remote control (2305)	AQ 0002			"	50 H LB 0500 L 102,103
Rubber foot	DF 7010			FILTER 25 c/s:	
Coaxial jack	JJ 0014			Polyester	1 $\mu\text{F} \pm 10\%/250\text{V}$ CS 0025 C 101-103
7-pole jack	JJ 0018			Trimmer pot.m.	300 k Ω lin. PG 4301 R 104,105
6-pole jack	JJ 4704			Coil	40 H LB 0104 L 102,103
Coaxial plug	JP 0018			"	40 H LB 0103 L 101
Mechanical adaptor	JP 0019			FILTER 31.5 c/s:	
Ground jack	JT 6204			Polyester	330 nF $\pm 10\%/250\text{V}$ CS 0019 C 101-103
Case, wood	KA 0012			"	470 nF $\pm 10\%/250\text{V}$ CS 0021 C 101-103
Case, metal	KQ 0010			Trimmer pot.m.	300 k Ω lin. PG 4301 R 104,105
Zener diode	12 V $\pm 10\%$	QV 1312	Q 1	Coil	31.5 H LB 0106 L 102,103
Germanium diode	OA 85	QV 0085	Q 2,3,13	"	31.5 H LB 0107 L 101
Frequency dial	SA 0206			FILTER 40 c/s:	
Bakelite knob	30 Φ	SN 0814		Polystyrene	630 nF $\pm 5\%/100\text{V}$ CT 6106 C 101-103
"	54 Φ	SN 3810		Trimmer pot.m.	300 k Ω lin. PG 4301 R 104,105
"	30 Φ twin marking	SN 0816		Coil	25 H LB 0408 L 102,103
Pointer for frequency dial	SV 0015			"	25 H LB 0409 L 101
Auto-transformer	TQ 0003	T		FILTER 50 c/s:	
Transistor 2N2374	VB 1022	V 1		Polyester	500 nF $\pm 5\%/100\text{V}$ CT 6107 C 101-103
"	VB 2022	V 2		Trimmer pot.m.	300 k Ω lin. PG 4301 R 104,105
WEIGHTING NETWORK					
Electrolytic	40 $\mu\text{F}/150\text{ V}$	CE 2038	C 89	Coil	20 H LB 0410 L 102,103
"	2 $\mu\text{F}/50\text{ V}$	CE 2648	C 99	"	20 H LB 0411 L 101
Ceramic	5 pF/500 V	CK 0034	C 90		

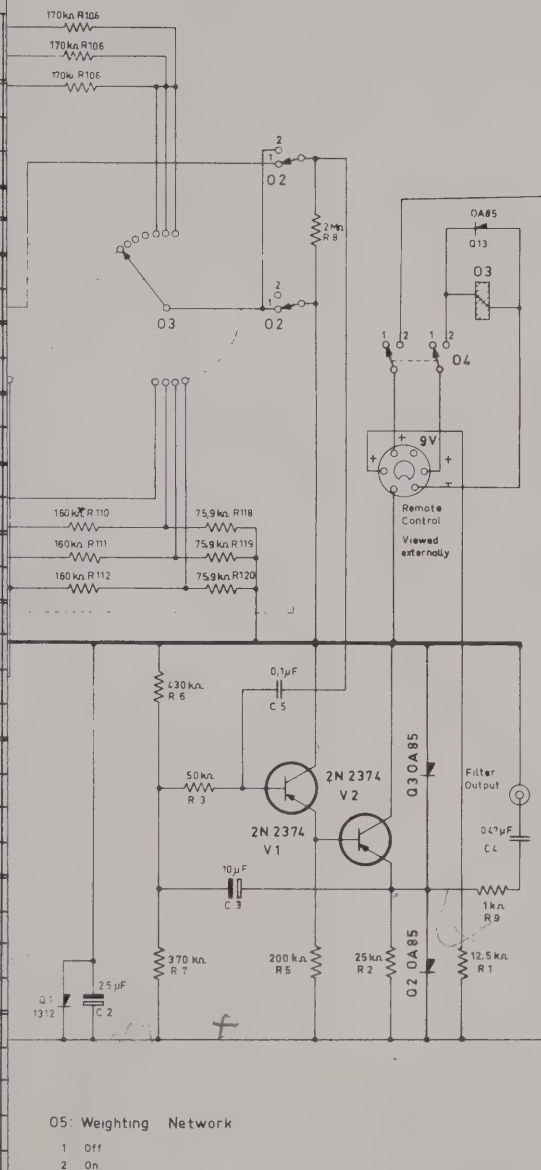
COMPONENT TYPE		STOCK REFERENCE	CIRCUIT DIAGRAM	COMPONENT		STOCK REFERENCE	CIRCUIT DIAGRAM	
FILTER 63 c/s:				FILTER 400 c/s:				
Polystyrene	400 nF [±] 5%/100 V	CT	6104	C 101-103	Polystyrene	63 nF [±] 5%/100 V	CT 3431 C 101-103	
Trimmer pot.m.	150 kΩ lin.	PG	4151	R 105	Trimmer pot.m.	500 kΩ lin.	PG 4502 R 101	
"	300 kΩ lin.	PG	4301	R 104	"	300 kΩ lin.	PG 4301 R 103, 104	
"		PG	4151	R 105	"	150 kΩ lin.	PG 4151 R 105	
Coil	16 H	LB	0412	L 102, 103	Coil	2.5 H	LB 0419 L 102, 103	
"	16 H	LB	0413	L 101	"	2.5 H	LB 0420 L 101	
FILTER 80 c/s:				FILTER 500 c/s:				
Polystyrene	320 nF [±] 5%/100 V	CT	6105	C 101-103	Polystyrene	50 nF [±] 5%/100 V	CT 3430 C 101-103	
Trimmer pot.m.	150 kΩ lin.	PG	4151	R 105	Trimmer pot.m.	500 kΩ lin.	PG 4502 R 101	
"	300 kΩ lin.	PG	4301	R 104	"	300 kΩ lin.	PG 4301 R 103, 104	
"		PG	4301	R 104	"	150 kΩ lin.	PG 4151 R 105	
Coil	12.5 H	LB	0414	L 102, 103	Coil	2 H	LB 0421 L 102, 103	
"	12.5 H	LB	0415	L 101	"	2 H	LB 0422 L 101	
FILTER 100 c/s:				FILTER 630 c/s:				
Polystyrene	250 nF [±] 5%/100 V	CT	6102	C 101-103	Polystyrene	40 nF [±] 5%/100 V	CT 3239 C 101-103	
Trimmer pot.m.	150 kΩ lin.	PG	4151	R 105	Trimmer pot.m.	1 MΩ lin.	PG 5102 R 101	
"	300 kΩ lin.	PG	4300	R 103	"	300 kΩ lin.	PG 4301 R 103, 104	
"	300 kΩ lin.	PG	4301	R 104	"	150 kΩ lin.	PG 4151 R 105	
Coil	10 H	LB	0116	L 102, 103	Coil	1.6 H	LB 0423 L 102, 103	
"	10 H	LB	0117	L 101	"	1.6 H	LB 0424 L 101	
FILTER 125 c/s:				FILTER 800 c/s:				
Polystyrene	200 nF [±] 5%/100 V	CT	6103	C 101-103	Polystyrene	31.5 nF [±] 5%/100 V	CT 3238 C 101-103	
Trimmer pot.m.	150 kΩ lin.	PG	4151	R 105	Trimmer pot.m.	1 MΩ lin.	PG 5102 R 101	
"	300 kΩ lin.	PG	4300	R 103	"	300 kΩ lin.	PG 4301 R 103, 104	
"	300 kΩ lin.	PG	4301	R 104	"	150 kΩ lin.	PG 4151 R 105	
Coil	8 H	LB	0118	L 102, 103	Coil	1.25 H	LB 0425 L 102, 103	
"	8 H	LB	0119	L 101	"	1.25 H	LB 0426 L 101	
FILTER 160 c/s:				FILTER 1 k c/s:				
Polystyrene	160 nF [±] 5%/100 V	CT	6101	C 101-103	Polystyrene	25 nF [±] 5%/100 V	CT 3237 C 101-103	
Trimmer pot.m.	150 kΩ lin.	PG	4151	R 105	Trimmer pot.m.	300 kΩ lin.	PG 4301 R 101, 104	
"	300 kΩ lin.	PG	4300	R 103	"	500 kΩ lin.	PG 4502 R 102	
"	300 kΩ lin.	PG	4301	R 104	"	150 kΩ lin.	PG 4151 R 103, 105	
Coil	6.3 H	LB	0120	L 102, 103	Coil	1 H	LB 0440 L 102, 103	
"	6.3 H	LB	0121	L 101	"	1 H	LB 0441 L 101	
FILTER 200 c/s:				FILTER 1.25 k c/s:				
Polystyrene	125 nF [±] 5%/100 V	CT	6100	C 101-103	Polystyrene	20 nF [±] 5%/200 V	CT 3230 C 101-103	
Trimmer pot.m.	800 kΩ lin.	PG	5101	R 101	Trimmer pot.m.	300 kΩ lin.	PG 4301 R 101, 104	
"	300 kΩ lin.	PG	4300	R 103	"	500 kΩ lin.	PG 4502 R 102	
"	300 kΩ lin.	PG	4301	R 104	"	150 kΩ lin.	PG 4151 R 103, 105	
"	150 kΩ lin.	PG	4151	R 105	Coil	800 mH	LB 0442 L 102, 103	
Coil	5 H	LB	0122	L 102, 103	"	800 mH	LB 0443 L 101	
"	5 H	LB	0123	L 101	FILTER 1.6 k c/s:			
FILTER 250 c/s:				FILTER 2 k c/s:				
Polystyrene	100 nF [±] 5%/100 V	CT	3433	C 101-103	Polystyrene	16 nF [±] 5%/100 V	CT 3236 C 101-103	
Trimmer pot.m.	300 kΩ lin.	PG	4301	R 103, 104	Trimmer pot.m.	300 kΩ lin.	PG 4301 R 101, 104	
"	150 kΩ lin.	PG	4151	R 105	"	500 kΩ lin.	PG 4502 R 102	
Coil	4 H	LB	0429	L 102, 103	"	150 kΩ lin.	PG 4151 R 103, 105	
"	4 H	LB	0430	L 101	Coil	640 mH	LB 0444 L 102, 103	
FILTER 315 c/s:				FILTER 2 k c/s:				
Polystyrene	80 nF [±] 5%/100 V	CT	3432	C 101-103	Polystyrene	12.5 nF [±] 5%/200 V	CT 3235 C 101-103	
Trimmer pot.m.	300 kΩ lin.	PG	4301	R 103, 104	Trimmer pot.m.	300 kΩ lin.	PG 4301 R 101, 104	
"	150 kΩ lin.	PG	4151	R 105	"	500 kΩ lin.	PG 4502 R 102	
Coil	3.16 H	LB	0427	L 102, 103	"	150 kΩ lin.	PG 4151 R 103, 105	
"	3.16 H	LB	0428	L 101	Coil	500 mH	LB 0446 L 102, 103	

COMPONENT TYPE		STOCK REFERENCE	CIRCUIT DIAGRAM	COMPONENT TYPE		STOCK REFERENCE	CIRCUIT DIAGRAM
<u>FILTER 2.5 k c/s:</u>				<u>FILTER 12.5 k c/s:</u>			
Polystyrene	10 nF $\pm$ 5%/200 V	CT 3228	C 101-103	Polystyrene	2 nF $\pm$ 5%/400 V	CT 3222	C 101-103
Trimmer pot.m.	300 k Ω lin.	PG 4301	R 101,104	Trimmer, ceramic	10-40 pF/250 V	CV 0019	"C"
"	500 k Ω lin.	PG 4502	R 102	Trimmer pot.m.	300 k Ω lin.	PG 4301	R 101,104
"	150 k Ω lin.	PG 4151	R 103,105	"	500 k Ω lin.	PG 4502	R 102
Coil	400 mH	LB 0432	L 102,103	"	150 k Ω lin.	PG 4151	R 103,105
"	400 mH	LB 0433	L 101	Coil	71.5 mH	LB 0532	L 102,103
				"	71.5 mH	LB 0533	L 101
<u>FILTER 3.15 k c/s:</u>				<u>FILTER 16 k c/s:</u>			
Polystyrene	8 nF $\pm$ 5%/200 V	CT 3227	C 101-103	Polystyrene	1.6 nF $\pm$ 5%/400 V	CT 3232	C 101-103
Trimmer pot.m.	300 k Ω lin.	PG 4301	R 101,104	Trimmer, ceramic	10-40 pF/250 V	CV 0019	"C"
"	500 k Ω lin.	PG 4502	R 102	Trimmer pot.m.	300 k Ω lin.	PG 4301	R 101,104
"	150 k Ω lin.	PG 4151	R 103,105	"	500 k Ω lin.	PG 4502	R 102
Coil	320 mH	LB 0434	L 102,103	"	150 k Ω lin.	PG 4151	R 103,105
"	320 mH	LB 0435	L 101	Coil	56.8 mH	LB 0534	L 103
				"	55.5 mH	LB 0535	L 102
<u>FILTER 4 k c/s:</u>				<u>FILTER 20 k c/s:</u>			
Polystyrene	6.3 nF $\pm$ 5%/200 V	CT 3234	C 101-103	Polystyrene	1.25 nF $\pm$ 5%/400 V	CT 3219	C 101-103
Trimmer pot.m.	300 k Ω lin.	PG 4301	R 101,104	Trimmer, ceramic	10-40 pF/250 V	CV 0019	"C"
"	500 k Ω lin.	PG 4502	R 102	Trimmer pot.m.	300 k Ω lin.	PG 4301	R 101,104
"	150 k Ω lin.	PG 4151	R 103,105	"	500 k Ω lin.	PG 4502	R 102
Coil	250 mH	LB 0436	L 102,103	"	150 k Ω lin.	PG 4151	R 103,105
"	250 mH	LB 0437	L 101	Coil	45.1 mH	LB 0537	L 103
				"	44.1 mH	LB 0538	L 102
				"	45.1 mH	LB 0539	L 101
<u>FILTER 5 k c/s:</u>				<u>FILTER 25 k c/s:</u>			
Polystyrene	5 nF $\pm$ 5%/200 V	CT 3226	C 101-103	Polystyrene	1 nF $\pm$ 5%/500 V	CT 0118	C 101-103
Trimmer pot.m.	300 k Ω lin.	PG 4301	R 101,104	Trimmer, ceramic	10-40 pF/250 V	CV 0019	"C"
"	500 k Ω lin.	PG 4502	R 102	Trimmer pot.m.	300 k Ω lin.	PG 4301	R 101,104
"	150 k Ω lin.	PG 4151	R 103,105	"	500 k Ω lin.	PG 4502	R 102
Coil	200 mH	LB 0438	L 102,103	"	150 k Ω lin.	PG 4151	R 103,105
"	200 mH	LB 0439	L 101	Coil	35.8 mH	LB 0540	L 103
				"	34.8 mH	LB 0541	L 102
				"	35.8 mH	LB 0542	L 101
<u>FILTER 6.3 k c/s:</u>				<u>FILTER 31.5 k c/s:</u>			
Polystyrene	4 nF $\pm$ 5%/200 V	CT 3225	C 101-103	Polystyrene	0.8 nF $\pm$ 5%/500 V	CT 0116	C 101-103
Trimmer, ceramic	10-40 pF/250 V	CV 0019	"C"	Trimmer, ceramic	10-40 pF/250 V	CV 0019	"C"
Trimmer pot.m.	300 k Ω lin.	PG 4301	R 101,104	Trimmer pot.m.	300 k Ω lin.	PG 4301	R 101,104
"	500 k Ω lin.	PG 4502	R 102	"	500 k Ω lin.	PG 4502	R 102
"	150 k Ω lin.	PG 4151	R 103,105	"	150 k Ω lin.	PG 4151	R 103,105
Coil	144 mH	LB 0526	L 102,103	Coil	28.5 mH	LB 0543	L 103
"	144 mH	LB 0527	L 101	"	27.8 mH	LB 0544	L 102
				"	28.5 mH	LB 0545	L 101
<u>FILTER 8 k c/s:</u>				<u>FILTER 40 k c/s:</u>			
Polystyrene	3.2 nF $\pm$ 5%/200 V	CT 3233	C 101-103	Polystyrene	0.63 nF $\pm$ 5%/400 V	CT 3214	C 101-103
Trimmer, ceramic	10-40 pF/250 V	CV 0019	"C"	Trimmer, ceramic	10-40 pF/250 V	CV 0019	"C"
Trimmer pot.m.	300 k Ω lin.	PG 4301	R 101,104	Trimmer pot.m.	300 k Ω lin.	PG 4301	R 101,104
"	500 k Ω lin.	PG 4502	R 102	"	500 k Ω lin.	PG 4502	R 102
"	150 k Ω lin.	PG 4151	R 103,105	"	150 k Ω lin.	PG 4151	R 103,105
Coil	113 mH	LB 0528	L 102,103	Coil	22.6 mH	LB 0546	L 103
"	113 mH	LB 0529	L 101	"	21.6 mH	LB 0547	L 102
				"	22.6 mH	LB 0548	L 101
<u>FILTER 10 k c/s:</u>							
Polystyrene	2.5 nF $\pm$ 5%/400 V	CT 3223	C 101-103				
Trimmer, ceramic	10-40 pF/250 V	CV 0019	"C"				
Trimmer pot.m.	300 k Ω lin.	PG 4301	R 101,104				
"	500 k Ω lin.	PG 4502	R 102				
"	150 k Ω lin.	PG 4151	R 103,105				
Coil	90 mH	LB 0530	L 102,103				
"	90 mH	LB 0531	L 101				

valid from serial no. 130631

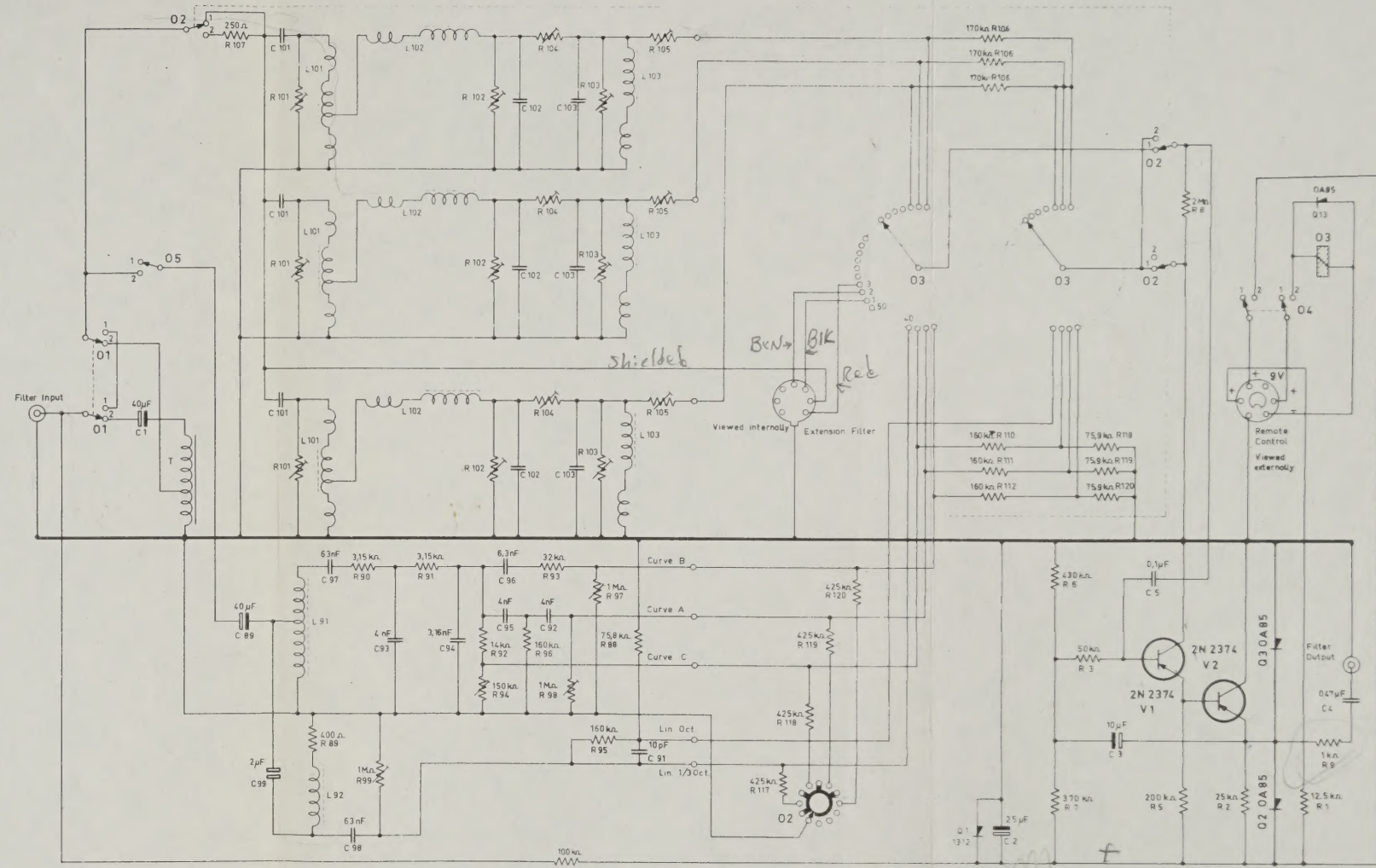
Circuit Diagram

Filter No.	Frequency c/s	L 101, 102 and 103 H	C 101- 103 nF	R 101 kΩ	R 102 kΩ	R 103 kΩ	R 104 kΩ
ZS 0146	12,5	80	2000				250
	16	63	1600				"
	20	50	1250				"
ZS 0048	25	40	1000				300
ZS 0049	31,5	31,5	800				"
ZS 0029	40	25	630				"
	50	20	500				"
ZS 0030	63	16	400				"
	80	12,5	315				"
ZS 0031	100	10	250			300	"
	125	8	200			"	"
ZS 0032	160	6,3	160			"	"
	200	5	125	(800)		"	"
ZS 0150	250	4	100			"	"
	315	3,15	80			"	"
ZS 0151	400	2,5	63	1000		"	"
	500	2	50	500		"	"
	630	1,6	40	1000		"	"
	800	1,25	31,5	500		"	"
ZS 0152	1000	1,0	25	500		150	"
	1250	0,8	20	300	500	"	"
	1600	0,63	16	"	"	"	"
	2000	0,5	12,5	"	"	"	"
ZS 0153	2500	0,4	10	"	"	"	"
	3150	0,315	8	"	"	"	"
	4000	0,25	6,3	"	"	"	"
	5000	0,2	5	"	"	"	"
ZS 0039	6300	0,16	4	"	"	"	"
	8000	0,125	3,15	"	"	"	"
	10000	0,1	2,5	"	"	"	"
	12500	0,08	2	"	"	"	"
	16000	0,063	1,6	"	"	"	"
ZS 0142	20000	0,05	1,25	150	"	"	"
	25000	0,04	1,0	"	"	"	"
	31500	0,0315	0,8	"	"	"	"
	40000	0,025	0,63	"	"	"	"



Band-pass Filter Set
Type 1612

Filter No.	Frequency c/s	L 101, 102 and 103 H	C 101- 103 nF	R 101 kΩ	R 102 kΩ	R 103 kΩ	R 104 kΩ	R 105 kΩ
ZS 0146	12.5	80	2000				250	300
	16	63	1600				"	"
	20	50	1250				"	"
ZS 0048	25	40	1000				300	"
ZS 0049	31.5	31.5	800				"	"
ZS 0029	40	25	630				"	"
	50	20	500				"	"
ZS 0030	63	16	400				"	150
	80	12.5	315				"	"
ZS 0031	100	10	250			300	"	"
	125	8	200			"	"	"
ZS 0032	160	6.3	160			"	"	"
	200	5	125	(800)		"	"	"
ZS 0150	250	4	100			"	"	"
	315	3.15	80			"	"	"
ZS 0151	400	2.5	63	1000		"	"	"
	500	2	50	500		"	"	"
	630	1.6	40	1000		"	"	"
	800	1.25	315	500		"	"	"
ZS 0152	1000	1.0	25	500		150	"	"
	1250	0.8	20	300	500	"	"	"
	1600	0.63	16	"	"	"	"	"
	2000	0.5	12.5	"	"	"	"	"
ZS 0153	2500	0.4	10	"	"	"	"	"
	3150	0.315	8	"	"	"	"	"
	4000	0.25	6.3	"	"	"	"	"
	5000	0.2	5	"	"	"	"	"
ZS 0039	6300	0.16	4	"	"	"	"	"
	8000	0.125	3.15	"	"	"	"	"
	10000	0.1	2.5	"	"	"	"	"
	12500	0.08	2	"	"	"	"	"
ZS 0142	16000	0.063	1.6	"	"	"	"	"
	20000	0.05	1.25	150	"	"	"	"
	25000	0.04	1.0	"	"	"	"	"
	31500	0.0315	0.8	"	"	"	"	"
	40000	0.025	0.63	"	"	"	"	"



- 01: Input Switch
1: Direct
2: Transformer
- 02: Function Selector
1: 1/3 Octave 0 db
2: Octave -10 db
- 03: Filter Switch
1-3: Extension Filters
4-36: 1/3 Octave or Octave Filters
37-40: Weighting Network
41-50: G. und
- 04: Automatic Switching
1: Off
2: On
- 05: Weighting Network
1: Off
2: On

25-S-61	64 072	3-3-54	130631
5-12-61	77518		
17-5-63	127286		

Brüel & Kjær
Copenhagen



Band-pass Filter Set
Type 1612

TABLE 1.1
Summary of Data

Year	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060	2061	2062	2063	2064	2065	2066	2067	2068	2069	2070	2071	2072	2073	2074	2075	2076	2077	2078	2079	2080	2081	2082	2083	2084	2085	2086	2087	2088	2089	2090	2091	2092	2093	2094	2095	2096	2097	2098	2099	2100																																																																																																																																																																																																																																																																																																																																																									
Population	100	105	110	115	120	125	130	135	140	145	150	155	160	165	170	175	180	185	190	195	200	205	210	215	220	225	230	235	240	245	250	255	260	265	270	275	280	285	290	295	300	305	310	315	320	325	330	335	340	345	350	355	360	365	370	375	380	385	390	395	400	405	410	415	420	425	430	435	440	445	450	455	460	465	470	475	480	485	490	495	500	505	510	515	520	525	530	535	540	545	550	555	560	565	570	575	580	585	590	595	600	605	610	615	620	625	630	635	640	645	650	655	660	665	670	675	680	685	690	695	700	705	710	715	720	725	730	735	740	745	750	755	760	765	770	775	780	785	790	795	800	805	810	815	820	825	830	835	840	845	850	855	860	865	870	875	880	885	890	895	900	905	910	915	920	925	930	935	940	945	950	955	960	965	970	975	980	985	990	995	1000																																																																																																																																																																																																																																																																																																							
GDP	100	105	110	115	120	125	130	135	140	145	150	155	160	165	170	175	180	185	190	195	200	205	210	215	220	225	230	235	240	245	250	255	260	265	270	275	280	285	290	295	300	305	310	315	320	325	330	335	340	345	350	355	360	365	370	375	380	385	390	395	400	405	410	415	420	425	430	435	440	445	450	455	460	465	470	475	480	485	490	495	500	505	510	515	520	525	530	535	540	545	550	555	560	565	570	575	580	585	590	595	600	605	610	615	620	625	630	635	640	645	650	655	660	665	670	675	680	685	690	695	700	705	710	715	720	725	730	735	740	745	750	755	760	765	770	775	780	785	790	795	800	805	810	815	820	825	830	835	840	845	850	855	860	865	870	875	880	885	890	895	900	905	910	915	920	925	930	935	940	945	950	955	960	965	970	975	980	985	990	995	1000																																																																																																																																																																																																																																																																																																							
Unemployment	5.0	5.2	5.4	5.6	5.8	6.0	6.2	6.4	6.6	6.8	7.0	7.2	7.4	7.6	7.8	8.0	8.2	8.4	8.6	8.8	9.0	9.2	9.4	9.6	9.8	10.0	10.2	10.4	10.6	10.8	11.0	11.2	11.4	11.6	11.8	12.0	12.2	12.4	12.6	12.8	13.0	13.2	13.4	13.6	13.8	14.0	14.2	14.4	14.6	14.8	15.0	15.2	15.4	15.6	15.8	16.0	16.2	16.4	16.6	16.8	17.0	17.2	17.4	17.6	17.8	18.0	18.2	18.4	18.6	18.8	19.0	19.2	19.4	19.6	19.8	20.0	20.2	20.4	20.6	20.8	21.0	21.2	21.4	21.6	21.8	22.0	22.2	22.4	22.6	22.8	23.0	23.2	23.4	23.6	23.8	24.0	24.2	24.4	24.6	24.8	25.0	25.2	25.4	25.6	25.8	26.0	26.2	26.4	26.6	26.8	27.0	27.2	27.4	27.6	27.8	28.0	28.2	28.4	28.6	28.8	29.0	29.2	29.4	29.6	29.8	30.0	30.2	30.4	30.6	30.8	31.0	31.2	31.4	31.6	31.8	32.0	32.2	32.4	32.6	32.8	33.0	33.2	33.4	33.6	33.8	34.0	34.2	34.4	34.6	34.8	35.0	35.2	35.4	35.6	35.8	36.0	36.2	36.4	36.6	36.8	37.0	37.2	37.4	37.6	37.8	38.0	38.2	38.4	38.6	38.8	39.0	39.2	39.4	39.6	39.8	40.0	40.2	40.4	40.6	40.8	41.0	41.2	41.4	41.6	41.8	42.0	42.2	42.4	42.6	42.8	43.0	43.2	43.4	43.6	43.8	44.0	44.2	44.4	44.6	44.8	45.0	45.2	45.4	45.6	45.8	46.0	46.2	46.4	46.6	46.8	47.0	47.2	47.4	47.6	47.8	48.0	48.2	48.4	48.6	48.8	49.0	49.2	49.4	49.6	49.8	50.0	50.2	50.4	50.6	50.8	51.0	51.2	51.4	51.6	51.8	52.0	52.2	52.4	52.6	52.8	53.0	53.2	53.4	53.6	53.8	54.0	54.2	54.4	54.6	54.8	55.0	55.2	55.4	55.6	55.8	56.0	56.2	56.4	56.6	56.8	57.0	57.2	57.4	57.6	57.8	58.0	58.2	58.4	58.6	58.8	59.0	59.2	59.4	59.6	59.8	60.0	60.2	60.4	60.6	60.8	61.0	61.2	61.4	61.6	61.8	62.0	62.2	62.4	62.6	62.8	63.0	63.2	63.4	63.6	63.8	64.0	64.2	64.4	64.6	64.8	65.0	65.2	65.4	65.6	65.8	66.0	66.2	66.4	66.6	66.8	67.0	67.2	67.4	67.6	67.8	68.0	68.2	68.4	68.6	68.8	69.0	69.2	69.4	69.6	69.8	70.0	70.2	70.4	70.6	70.8	71.0	71.2	71.4	71.6	71.8	72.0	72.2	72.4	72.6	72.8	73.0	73.2	73.4	73.6	73.8	74.0	74.2	74.4	74.6	74.8	75.0	75.2	75.4	75.6	75.8	76.0	76.2	76.4	76.6	76.8	77.0	77.2	77.4	77.6	77.8	78.0	78.2	78.4	78.6	78.8	79.0	79.2	79.4	79.6	79.8	80.0	80.2	80.4	80.6	80.8	81.0	81.2	81.4	81.6	81.8	82.0	82.2	82.4	82.6	82.8	83.0	83.2	83.4	83.6	83.8	84.0	84.2	84.4	84.6	84.8	85.0	85.2	85.4	85.6	85.8	86.0	86.2	86.4	86.6	86.8	87.0	87.2	87.4	87.6	87.8	88.0	88.2	88.4	88.6	88.8	89.0	89.2	89.4	89.6	89.8	90.0	90.2	90.4	90.6	90.8	91.0	91.2	91.4	91.6	91.8	92.0	92.2	92.4	92.6	92.8	93.0	93.2	93.4	93.6	93.8	94.0	94.2	94.4	94.6	94.8	95.0	95.2	95.4	95.6	95.8	96.0	96.2	96.4	96.6	96.8	97.0	97.2	97.4	97.6	97.8	98.0	98.2	98.4	98.6	98.8	99.0	99.2	99.4	99.6	99.8	100.0